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# POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. U.S. PAT. OFF.

SEE PAGE 542

# Right in your hand!

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A McSweeny trained man can go anywhere and make big money—the practical experience that the McSweeny Graduate Shops give you—no one can take away from you. The training is a key to success anywhere—because McSweeny trained men are in demand anywhere there are automobiles—and automobiles are everywhere.

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Down in Tennessee, Walter Creekmore makes as high as $20.00 a day. Fred Pendley was made chief mechanic in a Tennessee shop working on Packards and Cadillacs. George Smith is making $800.00 a month in Ohio.

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Tuition offer includes Board and Railroad fare.

**MAIL THIS COUPON** *for my* **FREE BOOK** *"Mac"*

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McSweeny Automotive and Electrical Training Shops,
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Dear Mac: Send me full details of your SPECIAL tuition offer and your FREE 65-page book.

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*A little thing to do—A big thing to accomplish*

The McSweeny Graduate Shops give you an experience in two short months, that would be difficult for you to get in a lifetime, merely working some place.

The McSweeny system is not a course in book study, but a period of intensive but easy training. It is an actual experience in the McSweeny shops, where equipment is modern and complete with automobiles, trucks, tractors and stationary engines.

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All the information, all the detail, of the McSweeny training plan, is contained in a handsome illustrated book, that is yours for the asking. It tells how McSweeny-trained men are earning big money. A few minutes now, while you think of it, and a 2c stamp will bring to you, this interesting story, and show you how you can travel anywhere, make big money, and be independent.

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## McSWEENY AUTO and TRACTOR GRADUATE SHOPS

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**EVEREADY HOUR**
**EVERY TUESDAY AT 9 P. M.**
*(Eastern Standard Time)*

For real radio enjoyment tune in the "Eveready Group." Broadcast through stations—

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# Recommend good batteries

In an effort to reduce the first cost of a radio set, a newcomer in radio often buys inferior batteries. *You* know such "saving" is really wasteful. Tell your friends who are about to buy receivers that the best batteries obtainable will prove to be the most economical. Tell them to buy Eveready Radio Batteries—they last longer and, because they are greatly superior, they give complete satisfaction.

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**EVEREADY**
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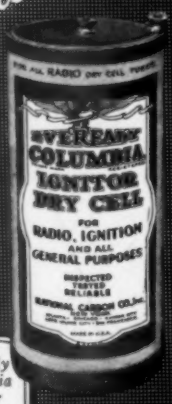
***—they last longer***




*Eveready Columbia Ignitor Dry Cell "A" Battery for all Dry Cell Tubes 1½ volts*

*No. 770 45-volt Extra Large Vertical Price $4.75 For use on multi-tube sets*

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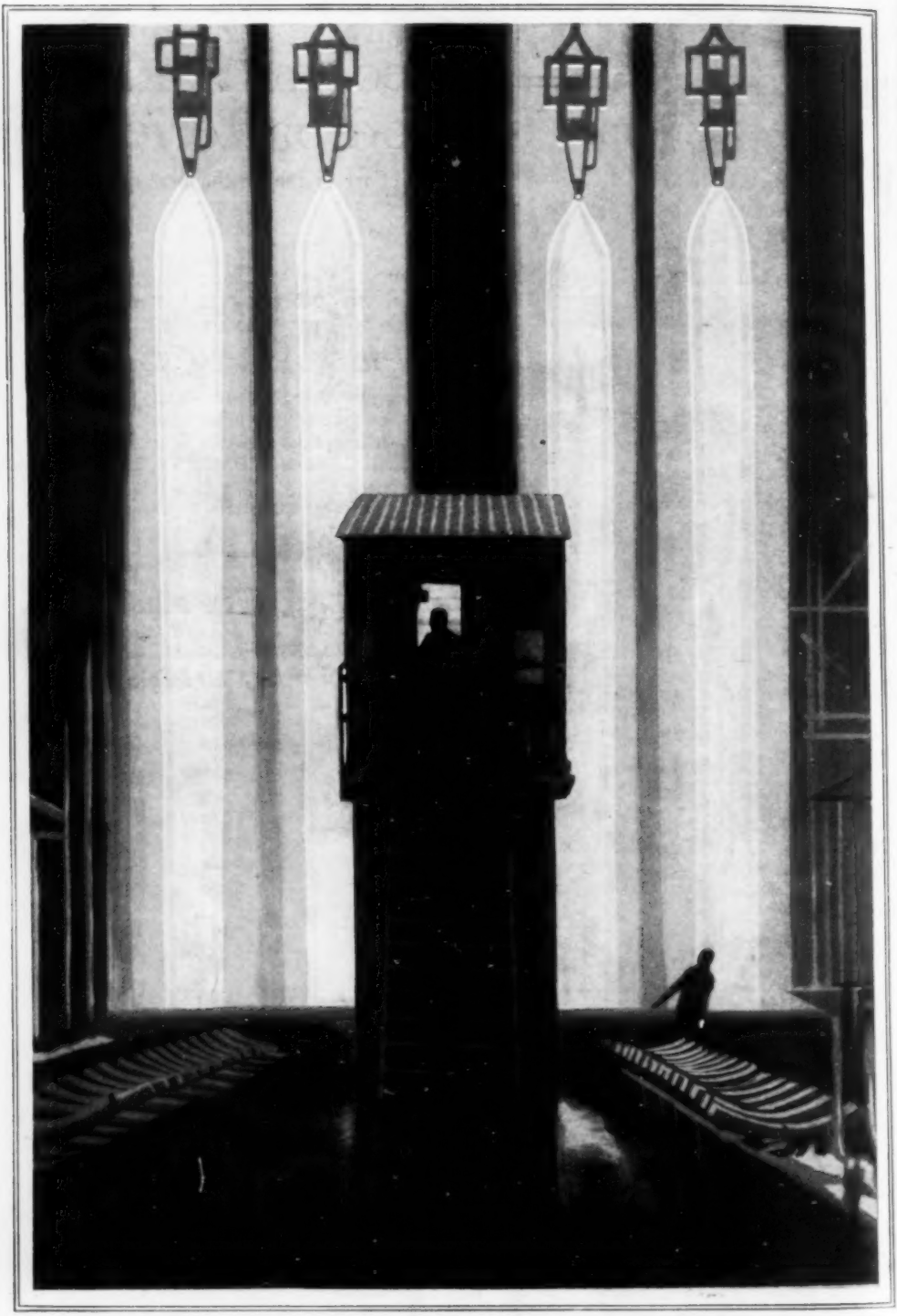

Like Cathedral Columns, Huge Glowing Cylinders of Molten Glass Rise Slowly Upward from the Furnace Pit as Air Blows the Incandescent Mass into Fragile Tubes—See Page 619

Popular Mechanics Magazine
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Vol. 44 OCTOBER, 1925 No. 4

# Cancer Germ Seen through Camera's Eye

## Most Powerful Microscope Ever Made Photographs Germs No Lens Has Disclosed Before as Step Forward in Disease Fight

ISOLATION of what research workers believe to be the real germ of cancer is claimed by two English scientists, working with a new type of ultra-microscope which photographs organisms so minute that the human eye cannot see them even with the best, earlier microscope.

The discovery does not mean an immediate cure for cancer, but it is hoped that further research work will indicate methods of vaccination which will render the virus harmless. The work so far accomplished indicates that the germs discovered by Dr. William Ewart Gye and Mr. J. E. Barnard, the two English scientists, are insufficient directly to cause cancerous growth, but that they combine with a chemical substance present in tumors to produce cancer.

Behind the discovery of the germ cell is an interesting story of a store proprietor who has worked mornings for many years as a hatter in order to earn money to spend his afternoons as a scientist. He is J. E. Barnard, the greatest living authority in England on microscopes. His unusual hobby won him a membership in the Royal Society, and when the war broke out, caused him to be placed in charge of microscope work for the army medical corps.

For four years, associated with Dr. Gye, he has sought to isolate the cancer germ, which is so small that it passes through the finest earthenware filters. Their success finally was made possible by the perfection of a complex microscope which utilizes the powerful short-wave ultraviolet light to photograph the micro-organisms, which ordinary sunlight will not do.

Dr. Michael Levine, American Scientist, Who Seeks Relation between Plant Cancer and Human Disease

Describing their work, Dr. Gye explains that the cancer virus they isolated, when combined with virus-free extract of tumor and injected into the veins of mice and chickens, set up malignant cancerous growths. The tumor extract, called by Dr. Gye the "specific factor," apparently helps the cancer virus to break down the defense of the cells of the animal, allowing the virus to enter them, infect the tissue, live and multiply, and at the same time provoke the cell to continued multiplication, thereby producing cancer.

The work of the English scientists continued investigations made twelve years ago by Dr. Francis Peyton Rous, famous pathologist of the Rockefeller Institute, who tracked down the virus and established its existence as a very small but active microbe, though he was never able to see or photograph it.

Even with the microbe isolated and identified, the search for a cancer cure still has a long way to travel. It is known that the disease may be produced by constant irritation of the flesh, whether caused by a bruise or by some other agency. Certain heavy oils, paraffin and coal tar are among the known irritants. In recent experiments with crude oil, Brit-

ish research workers produced tumor growths in mice when subjected to eight out of twelve samples of oil tested. A curious result was that only the crude, heavy oils produced cancer, while the refined and volatile liquids, such as gasoline and kerosene, did not have the same effect.

Despite the fact that the connection between such irritants and the start of cancer has been known for many years, Dr. Gye explains that he is still in the dark as to how the irritant produces the infection. In the laboratory experiments, the virus, along with the specific extract, was injected into the animals, but this, he continues, "was done in the laboratory and not by nature."

Microbes, such as those of cancer, belong to a family of about fifty, all invisible to the eye using the ordinary microscope. A sequel to the discovery of the cancer virus may be the discovery of a preventive vaccine, as distinct from a cure for cancer. The English doctor is now at work on the experimental farm of the National Institute for Medical Research, carrying out tests on chickens, with a view to finding an active agent which will render immune, first birds, then people, against cancer

All these medical and scientific wonders depend largely upon the perfection of the new ultra-microscope, the latest weapon in the war on disease. The ordinary microscope allows the observer to see, at its greatest degree of magnification, anything larger than a wave length of ordinary light. The ultra-microscope goes farther. It permits the observer to see, not the invisible particles of bacteria, but the deflection they cause to an intense beam of light passing at right angles to the microscope, and across a film of liquid containing the microbe. The scientist, looking through the eyepiece of the instrument sees only a dark background. If, however, a moving particle, like a mote in a sunbeam, crosses the light, which does not shine into the microscope, that moving particle reflects the light and a faint, luminous appearance is seen by the eye to be moving on the black background of the lens.

The new microscope looks very unlike the ordinary brass-mounted lens of the laboratory worker or the field entomologist. It resembles an engineers' lathe, and is rigidly built to withstand vibration or looseness of any kind, and to insure the greatest possible precision. An essentially novel part of the mechanism is a "dark ground illuminator" made of quartz lenses, which, unlike ordinary glass, transmit the short-wave, ultraviolet rays for photographing the filtrate containing the cancer virus.

This optical system allows the amazingly minute microbes to be seen by their reflected light. Mr. Barnard found that the green line in the spectrum of mercury, as in the mercury-vapor lamp, best enabled the eye to see the reflected light of the germ particles. He therefore uses this lamp to reveal the presence of these ultra-microscopic microbes to the eye.

Three-Hundred-Thousand-Volt X-Ray Machine for Deep Therapy Treatment of Cancer, the Latest Curative Method Established in Chicago Hospital to Attack Diseased Cells

## MANY QUEER PHONE PROBLEMS MET IN FAR LANDS

When a telephone installation gang in the Balkans recently started to trim off some obstructing limbs on a plane tree, a riot was nearly precipitated because the natives held this tree in veneration and to cut off any part of it is considered a sacrilege. Several years ago, when telephone engineers were constructing a system in the South Sea islands, it was found almost impossible to get the natives to work a sufficient length of time to set the poles. Then, again, it was found necessary to provide a special type of shovel to accommodate the bare feet of the workers. In Iceland, at times in winter, the wires become incased in ice sheaths six inches in diameter, and poles twenty-three feet high have been known to be completely covered by drifting snow. Iceland ponies form the chief method of transportation for supplies. In northern Sweden a telephone line has been constructed up beyond the Arctic circle and is used by the government for the transmission of weather bulletins and information of snow conditions for wandering tribes of Laps, who depend upon half-wild reindeer herds for their food and clothing. At the request of the Lamas, a telephone line has been constructed to the Forbidden City of Lhasa, more than 144 miles of this line being constructed over the roughest possible kind of country. In Egypt, a line has been run through the Valley of Kings. These examples illustrate some of the special requirements which have carried the telephone into remote and picturesque quarters of the globe.

## SALT BEDS UNDER VAST AREA A THOUSAND FEET THICK

That the southwest United States rests on a bed of salt averaging 500 feet thick, is the conclusion geologists are drawing from the nature of cores brought up from oil wells all over the region. The bed is known to be under the surface soil of 40,000 square miles of Texas and is believed to extend far into New Mexico, Oklahoma and Kansas. Some Texan wells have been drilled through strata of salt more than a thousand feet thick.

## ART OF VEGETABLE SCULPTOR FINDS READY MARKET

Flowers carved from vegetables are being used for table decorations at Pacific coast banquets and are furnishing pocket money to the woman who makes them. Taught by an uncle and enjoying the work as a diversion, the "sculptor" did not turn the practice into a money-maker until clubs and associations began to order bouquets made up of carrots, red beets, turnips, potatoes and radishes. Eggs are also used and twigs of trees and bushes furnish the necessary greens. Carving is done from the bottom of the vegetable upward.

Basket of "Flowers" Carved by Woman Who Discovered Source of Extra Money in Art Developed as a Pastime

## FOUNTAIN-PEN TYPE CLEANER HAS OIL IN HANDLE

Built and acting like a fountain pen, a new typewriter key cleaner is meeting favor from stenographers. The small brush is screwed into a glass handle which contains a cleaning solvent. This fluid seeps slowly into the brush and the typist always has a film of the penetrating oil on the keys as she rubs them. Instant disappearance of ink and dust is reported. The hollow handle will hold oil for thirty-five to fifty cleanings.

Weight Lost during Sleeping Hours Is Measured Accurately by These Delicately Adjusted Scales

## WEIGHT LOST IN SLEEP SHOWN BY DELICATE SCALE

Scales so accurately adjusted that they can measure the ounces lost by a man during a night's sleep are being used at Carnegie Institute to study changing conditions in the body. The balance is so delicate that it records the exact amount the subject loses in a few minutes through the evaporation of perspiration or by exercise. Everyone becomes lighter by a small amount during the hours of sleeping, and the exact loss is determined by weighing at night and in the morning.

## SOME PLANTS WORK OVERTIME UNDER LIGHT, OTHERS NOT

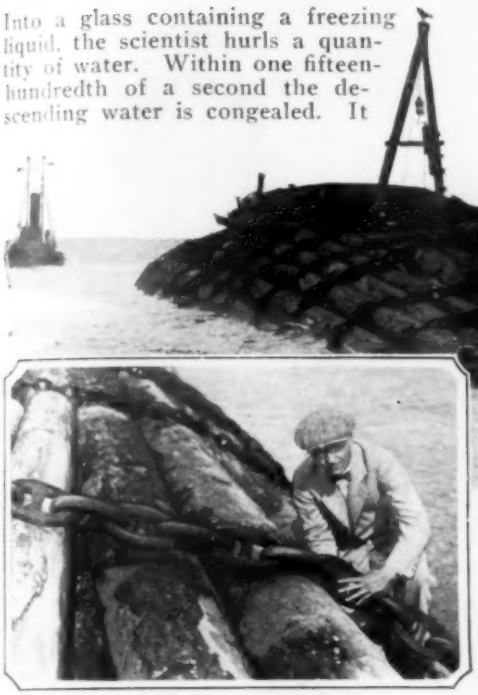
Plants which must have a night's rest in darkness, others which can stand a reasonable amount of night life in a "gay white way," and still a third class that flourishes under continuous lighting, have been segregated into groups as a result of research work at the Boyce Thompson institute at Yonkers, N. Y. That some plants thrived amazingly when raised under electric lights has been known for many years, but the research work disclosed for the first time that others must have their regular nightly rest in darkness. Radish, lettuce, barley and clover proved they could thrive under continuous twenty-four hour lighting, maturing much earlier than when grown under ordinary conditions. Buckwheat and soy beans, on the other hand, were retarded when subjected to night lighting, while certain flowers, including salvia and cosmos, refused to bloom at all unless they got their night's rest regularly. Certain sharp contrasts were disclosed by the investigation. Tomatoes grew faster and made better plants when they received up to seventeen hours of light each day, but with more than seventeen hours' lighting the plants dwindled, while continuous light killed them entirely. Clover, on the other hand, flourished under twenty-four hour light and produced flowers in thirty-five days, whereas it may take field clover two years to flower. In addition to lighting experiments, the laboratory tried introducing carbon dioxide gas into the greenhouses with marked beneficial effect in the case of several plants.

## WATER IS FROZEN SO QUICKLY AN EXPLOSION RESULTS

Freezing water too rapidly for the eye to follow the action is the experiment being performed by a refrigeration expert.

Water Exploding into Ice as It Comes in Contact with Refrigerating Liquid

Into a glass containing a freezing liquid, the scientist hurls a quantity of water. Within one fifteen-hundredth of a second the descending water is congealed. It



explodes into bits of ice and cold vapor the moment it hits the liquid in the lower glass. The instant the water left the upper holder, the experimenter snapped the camera and caught the explosion.

## DOGS TALK WITH THEIR TAILS

Dogs talk with their tails, a famous author of animal stories asserts, and traces the ability to their wild ancestors. When a savage canine saw another approaching, he walked toward him warily until he was certain the other had no evil intent. Each had a white tip to his tail and when the home dog decided the other might be a potential friend, he raised the white flag of truce and waved it to and fro. The other responded in like manner and so all dogs do today.

## HONEY BATH FOR SICK PEARLS RESTORES THEIR LUSTER

Baths in newly gathered honey are recommended by a European gem expert to restore the luster to pearls that have grown dull. Treatments of forty-eight hours at two-week intervals for a period of about six months, are said to produce the most satisfactory results and the honey should be removed with alcohol instead of water.

## NINE-HUNDRED-FOOT LOG RAFTS IN STRANGE RACE

Racing down the Pacific coast from Astoria, Oreg., to San Diego, Calif., a huge raft of logs, 900 feet long, made a record recently when the trip was completed in fifteen days. Its rival, another large raft, reached the port a full day behind. While the contest was mainly one between the tugs that pulled them, the rafts themselves were important factors, for upon their careful construction depended much of the success of the journey. The logs, joined together with large chains, were shaped into the form of a giant ship with a sharp nose to aid in making speed. The winner contained 5,000,000 feet of lumber. At about the middle, a support was rigged to hold a warning lamp which was lighted at night to prevent collisions with ships.

**Tug Pulling 5,000,000 Feet of Chained Logs Wins Race down Pacific Coast**

## TIGHTENER FOR CLOTHES LINE ELIMINATES EXTRA POLES

Intermediate supports or poles to keep the clothes lines from sagging are replaced by a small drumlike tightener that may be quickly attached to the wall or any convenient place. It has two short, projecting arms between which the end of the rope is fastened. The line is drawn to the desired tightness by winding the revolving drum. To loosen the line, the ratchet mechanism in the drum is disengaged by turning a wing screw at the bottom.

Parcel-Post Packages of Merchandise Which Failed to Reach Their Destination at Washington, D. C., Because of Poor Addressing; F. C. Staley, Superintendent of the Division of Dead Letters Is Checking Them Preparatory to Their Sale at Auction

Checking Over the "Nixies" before Sending Them to the Dead-Letter Office, Above; Left, a Set of False Teeth and a Bottle of Poison Hidden in a Book

Some of the Post-Office Nixie Sleuths at Work, Trying, with City Directories and Telephone Books, to Run Down the Correct Addresses and Send Letters on Their Way; Over 500 of These Clerks Are Employed in the New York Post Office and More Than 600 in Chicago

One Day's Collection of More than 25,000 Dead Letters in the Washington Post Office; New York and Chicago and Other Large Cities Have Proportionately Larger Numbers

# Uncle Sam's Swivel-Chair Sleuths Solve Millions of Mysteries Every Year

## Dead-Letter Office Reveals Many Tragedies and Comedies That Drift to "Port of Missing Mail"

by WALTER E. RODERICK

UNCLE Sam employs in the post-office department hundreds of sleuths who, seldom moving from their desks or letter racks, annually solve thousands of mysteries, some tragic, some humorous, but all of them having a more or less important bearing upon the lives of the letter writers of the nation.

These swivel-chair detectives are the clerks in the "nixie" section and the dead-letter office. Each year they are presented with more than 200,000,000 cases to solve and in approximately 179,000,000 of them they give the correct answer.

That is a pretty fair average when the knottiness of some of their problems is considered. They not only have to outguess the man who meant to send his letter to Pittsburgh, Pa., instead of to Pensacola, Fla., and supply missing street numbers for other thousands of absent-minded and careless individuals, but also are called upon to decipher some of the queerest written enigmas that might have baffled even a Sherlock Holmes. And all this service is costing the federal government in the neighborhood of $5,000,000 a year simply because individuals and firms are too lazy or too indifferent to place a "return card" on their envelopes. A return card is post-office parlance for the name and address of the sender, which should always be placed in the upper left-hand corner of the envelope; never on the back. There is no excuse for this oversight, the post office points out, because every person knows his own address even if he doesn't know that of the person to whom he is writing.

Because of the huge and ever-increasing volume of nixies the post-office force is not able to give each individual letter as much attention as in the days when there were fewer and more careful letter writers. Where only about fifteen improperly or incompletely addressed letters used to arrive each day at the post office in Washington, D. C., there is now a

Letter-Opening Machine Used in the Dead-Letter Office; with One Clerk Feeding It and Another Removing the Opened Letters, the Machine Can Handle 300 Missives a Minute, Preparing Them for Examination to Find Clues to Sender or Addressee

daily average of about 8,000. When it is considered that a vastly larger number pour each day into post offices in cities like New York, Chicago, Boston and Philadelphia, some idea may be gained of the magnitude of the task of keeping this backwash from the mail stream from piling up and hopelessly clogging the system. Yet the nixie sleuths and the dead-letter experts, with knowledge gained by long experience, are almost uncanny in their ability at getting these waifs and strays either back to their authors or to the persons for whom they were intended when dropped into the corner letter box.

Let's see how these sleuths operate. Suppose a letter is sent to "Mr. I. M. Wrong, 12th and Walnut streets, Washington, D. C." It reaches the Washington post office and is dumped from the sack on a counter where a long line of distributors stand tossing letters into pigeonholes bearing the labels of the various substations in the city. The distributor knows there is no Walnut street in Washington. If there is a return card on the envelope he sends it back to the writer to supply a correct address. If there is none, he tosses it into a box marked "miscellaneous." There the letter first leaves the normal current of the mails. It becomes delayed or "sick" mail, and must be given "hospital" treatment. It is a nixie.

From these miscellaneous boxes the mail is carried over to a central miscellaneous rack in charge of an expert distributor. He is the first sleuth to tackle the puzzle. These expert distributors carry thousands of streets in the backs of their heads. Their minds operate like cash registers. As soon as the optic nerve registers a street name, up jumps the name of a city. Broadway, Fifth avenue, Lennox avenue at once bring to mind New York. State street, Michigan avenue, Clark street and Madison street conjure up Chicago. Broad, Walnut and Chestnut streets associate themselves with Philadelphia, Olive street with St. Louis, Euclid avenue with Cleveland, and so on. In the case of the letter in question, the distributor re-addresses it to Philadelphia where it is delivered. Of course, there are many cities with similar street names and some letters make the rounds of several before reaching the rightful owners.

The distributors also have to be familiar with the nicknames applied to various sections and suburbs of cities, names that are not listed in postal guides, but which are often used by the ignorant in addressing letters. They must know, for instance, that "Kerry Patch" is in St. Louis, "Streeterville" in Chicago and "Hell's Kitchen" in New York city.

### DO YOU KNOW

That 21,000,000 letters went to the dead-letter office last year?

That 803,000 parcels did likewise?

That 100,000 letters go into the mail yearly in perfectly blank envelopes?

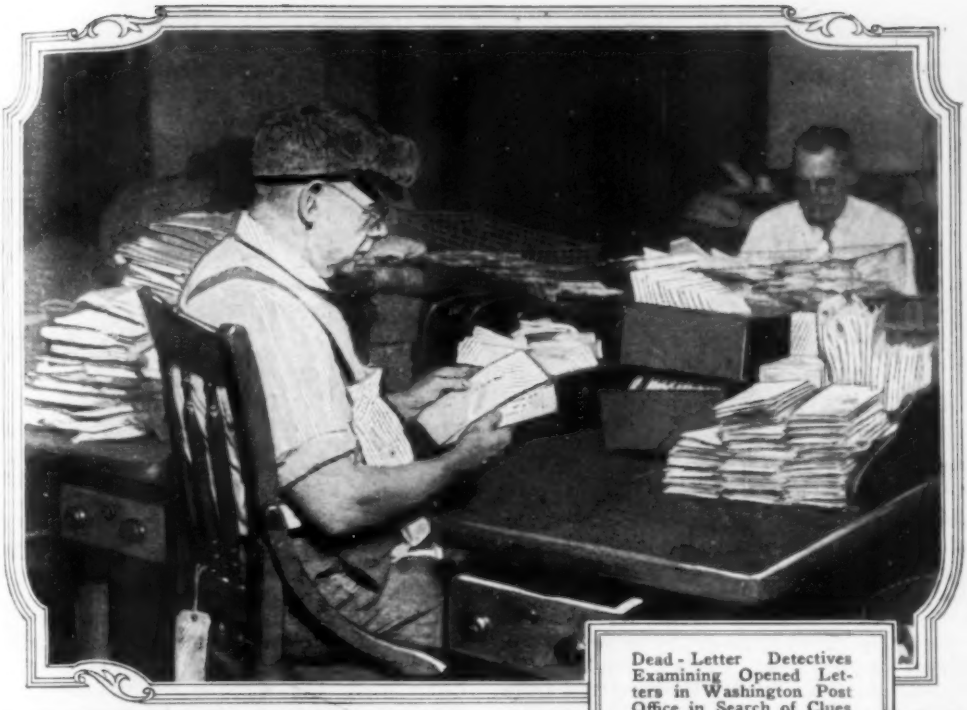
That $55,000.00 in cash is removed annually from misdirected envelopes?

That $12,000.00 in postage stamps is found in similar fashion?

That $3,000,000.00 in checks, drafts and money orders never reach intended owners?

That Uncle Sam collects $92,000.00 a year in postage for the return of mail sent to the dead-letter office?

Take another case. Suppose the letter is addressed to the right city but bears an impossible street number. The expert distributor passes that along to the direc-



Dead-Letter Detectives Examining Opened Letters in Washington Post Office in Search of Clues for Forwarding Them

Pile of Pipes, Currency, Jewelry and Other Articles Mailed to American Soldiers in France and Never Delivered Because of Faulty Addresses

William M. Mooney, Washington Postmaster, and Some of the Brain Teasers Solved by His Sleuths and Eventually Forwarded

tory-service division. This is what is commonly referred to as the nixie section. Here sit rows of women clerks—the women came in during the war and have stuck to their posts—with city directories cut up into sections alphabetically. Thus one clerk may have names beginning with "T" and another the section containing the "G's." These sleuths search out the name of the addressee and if there be a number of residents with the same name, pick out the one whose address more nearly corresponds to that on the envelope. There are over 600 clerks employed in the directory-service branches of the Chicago post office and over 500 in New York city.

If the sleuths in the directory service give up a letter as hopeless or carriers return it after vainly trying to locate the addressee, the letter is not yet turned over to the dead-letter office. It goes to a "rest camp," a rack that is placed near the general-delivery window, where it is held for ten days before being sent to the dead-letter office.

There are four dead-letter offices. One is at New York, which handles the dead mail for that state and all New England. The Washington office handles all mail from Pennsylvania and the south Atlantic states. The third is at Chicago, which handles the mail for the entire Mississippi valley, while the fourth, at San Francisco, takes care of all letters west of the Rockies. The daily receipts at the Washington dead-letter office average from 25,000 to 30,000. Here the letter is opened for the first time. For this purpose a machine is used which opens 300 envelopes a minute. The opened envelopes are distributed among other sleuths, who run through the contents searching for clues to the identity of the sender. Perhaps the letter has been carelessly addressed to Pittsburgh but the writer hopes the addressee is enjoying better weather "in Palm Beach." The letter is forwarded to Palm Beach, but a fee of three cents is charged. The fee also is charged if the letter, after being opened, is returned to the sender. These fees amount to $92,000 a year. All dead mail which cannot be delivered is destroyed with the exception of that containing money. A record is kept of that and held for a year. Each year the dead-letter offices take $55,000 in cash, $12,000 in stamps and $3,000,000 in checks, drafts and money orders from misdirected mail. Recently a letter came to the Washington office containing five crisp new twenty-dollar bills. It had been sent by a woman in Iowa to another woman in Pennsylvania as conscience money. The dead-letter sleuths could find no clue to the identities of either the sender or the addressee.

There are twelve regional dead-letter offices for handling parcel post because of its bulk. Most of this goes astray because it is improperly wrapped and the address is torn from the package. Merchandise is held for thirty days and then sold. If it is insured, it is held sixty days. Auctions are held semiannually, or more often if the accumulation of stuff necessitates.

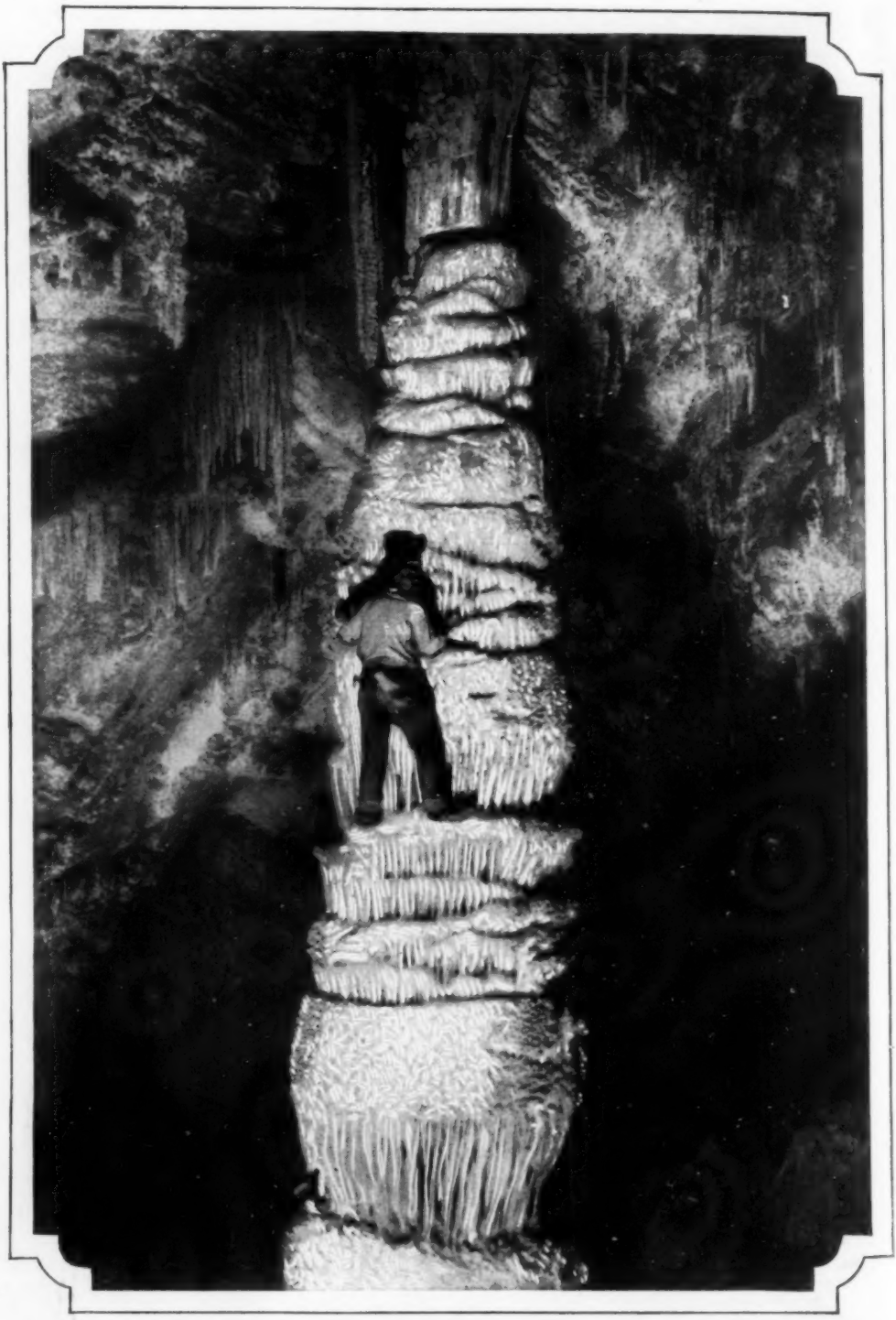
Firearms and such forbidden articles as explosives, poisons and drugs are destroyed. All sorts of schemes are resorted to in sending poisons and drugs through the mails. Books are hollowed out and bottles inserted. A harmless-looking pocketknife turned out to be a pistol. The Washington authorities stopped wholesale shipment of drugs into the District of Columbia jail by means of picture postcards. The postcards would be split, the drug in powder form inserted and the layers of cardboard pasted together again.

# TRAIL OF PREHISTORIC MAN IS FOUND IN ROCKS

Prehistoric Animals Pictured on Rocks in National Park; a Reindeer Being among the Subjects

Animal life of prehistoric eras is pictured in carved rocks on a bluff near the cave-dwelling ruins of Zion National park. Painstakingly sculptured in the hard rock are images of what appear to be dinosaurs, reindeer and big men. It is believed that the dwellers in the rock and adobe cliff homes near by were the artists who did the work many thousands of years ago. An authority recently stated that much ancient art, such as that of the Cro-Magnon race, is as good as that of moderns, but the pictures just discovered are merely the crudest outlines.

Explorers in Zion National Park Stumble on Shattered Remnants of Homes Used by Cliff Dwellers



© J. W. Walker

**One of Nature's Cavern Wonders, Stalactite and Stalagmite Linked as a Fantastic Pillar with Smaller "Icicles" of Stone Adorning the Sections That Form a Ladder**

## NEVADA CAVE ATTRACTS GAZE OF SCIENTIFIC WORLD

Dwarfing all others so far discovered in Nevada, the newly located Whipple cave, near Ely, is attracting the attention of scientists. Plans are now being made to open it to the public. One of the attractions is stalactites of gigantic size formed by the slow dripping of water from the roof. Subterranean caverns containing these deposits of lime and other minerals are paying properties in several parts of the world, particularly in Australia and the United States. Mammoth cave, in Kentucky, is visited by great throngs of tourists every year who pay to follow a guide for miles underground and inspect the beautifully colored growths that the slow, steady dripping has produced.

## CINDER IN ENGINEER'S EYE INSPIRES AN INVENTION

Because a cinder fell into the eye of Thomas E. Murray, senior vice president of the New York Edison company, more than 100 tons of dust and cinders are being removed daily from the air of that city. Mr. Murray was riding on a train, fifteen years ago, when he suffered the inconvenience so common to travelers. The way his eyes watered and washed the obstruction out set him thinking. Why not adapt the same method to removing such objects from the smoke before they get into the air? He set to work, and after many experiments, the apparatus now in use was devised. It consists mainly of a long, horizontal tank half-filled with water, along the top of which, within a few inches of the water level, extends a sheet of steel called a baffle plate. As the gases and cinders leave the fire, they are forced by a strong draft into the tank while the smoke, passing over the surface of the water receives additional cleansing before it reaches the flues. The system has created a unique job for one man. He is the official smoke watcher for the plant. His task is to sit in a tower all day where he can command a full view of the chimneys. By his expert scrutiny of the smoke, he can determine if the fires are being regulated properly. When too much smoke appears, he warns the stokers by means of red lights turned on from his desk.

## LIGHTED COLOR ROLLS TELL STORIES FOR CHILDREN

Pictures and stories are shown to children in a novel way by means of an electric lighted cabinet in which illustrated and printed rolls are inserted and turned with a crank. The reel passes in front of the bulb and is viewed in a convenient space at the front. The rolls are easily changed, the box consumes but little current and is simply and safely operated.

Story Cabinet in Use; Bulb Back of Roll Lights Up Pictures and Text

## FREE SHADE IS LATEST LUXURY FOR DESERT MOTORISTS

To give his customers opportunity to rest and refresh themselves after their cars are filled, a California gasoline-station proprietor has erected a large wooden shed under which motorists may enjoy free shade from the hot desert sun. There is sufficient space for several automobiles at once, and besides furnishing tourists with a welcome comfort, the shelter provides them with a safe parking place for their cars.

Welcome Shelter from the Sun Greets the Motorist under This "Free Shade" Shed

# HIGH-PRESSURE LOCOMOTIVE HAS GREATER POWER

Locomotive That Develops between 350 and 400 Pounds' Steam Pressure

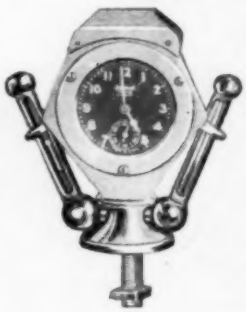
Styles in locomotives, like those of autos, change as builders seek greater efficiency. One of the most radical departures is the "Horatio Allen," an engine owned by the Delaware & Hudson railroad and named after the first man to operate a locomotive in America. The slim streamline design of the usual greyhound of the rails has been discarded, making the engine appear higher and stockier than the usual type. It has both flues and a series of pipes like the tubes in a Scotch marine boiler. These pass directly over the grates producing a steam pressure of from 350 to 400 pounds and increased pulling power. The "Horatio Allen" weighs 297,000 pounds on its drivers, each of which is fifty-seven inches high. An interesting example of locomotive efficiency was presented in Indiana recently when two engines were hooked to a railroad bridge and raised it to a height of over twenty-three feet so that a dredge could pass underneath. Raising and lowering were accomplished in eight and one-half minutes.

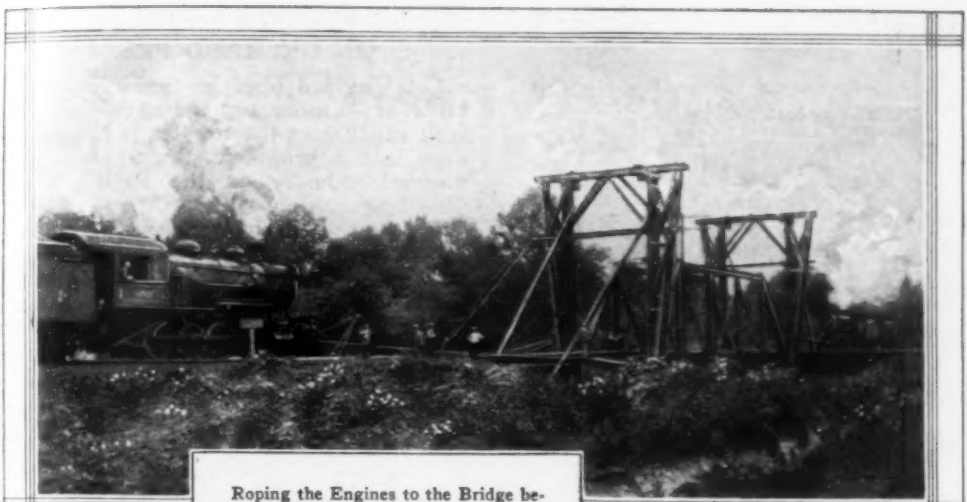
## BUTTER MADE FROM TALLOW TO SAVE MILK

Butter which contains no milk but is said to be palatable, nutritious and cheap is being prepared by a European chemist. He uses waste fats and tallow, first washing them in cold water and then cutting them into small pieces and melting them by steam in wooden vessels. Acid soda is then added and the substance boiled for several hours, after which it is strained through flannel and churned. Oil or sour milk may be added if desired, but they are not necessary. By adding a small quantity of honey, the taste is improved and the artificial butter is said to keep better and go ten per cent farther.

## CLOCK ON AUTO-RADIATOR CAP VISIBLE ON DARKEST NIGHT

A combined clock, water gauge and thermometer has been invented which will fit any lock-on radiator cap. The hands and figures of the clock are illuminated so that they are visible on the darkest night. As the timepiece is directly in the driver's line of vision, it is never necessary for him to take his eyes from the road. The thermometer gives the temperature of the radiator and the gauge tells of any shortage of water.





Roping the Engines to the Bridge before Lifting; the Wooden Uprights at Each End Formed a Track for the Structure

Steel Bridge Up Twenty-Three Feet Six Inches and Canal Dredge Passing Underneath with Ample Clearance; the Actual Raising and Lowering Were Accomplished in Eight and One-Half Minutes, Then the Bridge Was Quickly Placed Back on Its Supports and the Wooden Uprights Cleared Away

Insulators for the Sending Apparatus of Transatlantic Radio Stations Are Taller Than a Man

## INSULATORS BIGGER THAN MAN USED FOR ANTENNA

Transatlantic sending aerials require main insulators which are taller than a man, in striking contrast to the tiny insulators of the listener's receiving antenna. Part of the great size and strength is due to the fact that the aerial is charged with currents of 100,000 volts and more. Another reason is that the insulator must help bear the severe load of the antenna wire; in one station this wire is three-eighths of an inch thick and one and one-half miles long.

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¶There are five chickens to every person in the United States. Latest figures on the yearly egg production set the crop value at above $600,000,000. Live poultry is valued at about $409,000,000, and yearly sales as food amount to half a billion dollars.

## THREE MILLION LADYBUGS WAR ON ORCHARD PESTS

Catching ladybugs in the high mountains of Washington state to save the fruit ranches of the low lands has developed into a profitable, though decidedly unusual industry on the Pacific coast. One bug hunter, who is known as the "king of the ladybug industry" supplied 3,000,000 of the insects to fruit growers this year, but reported the "crop" was 6,000,000 short in the hills. The insects are transported in cages to the fruit ranches and "planted" in quantities of about 1,000 to the acre. They thrive and multiply rapidly, and with their numerous progeny attack the green and woolly aphis, the peach-tree louse and other orchard pests.

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## VESTIBULED STREET-CAR TRAIN ADDS SAFETY ON CURVES

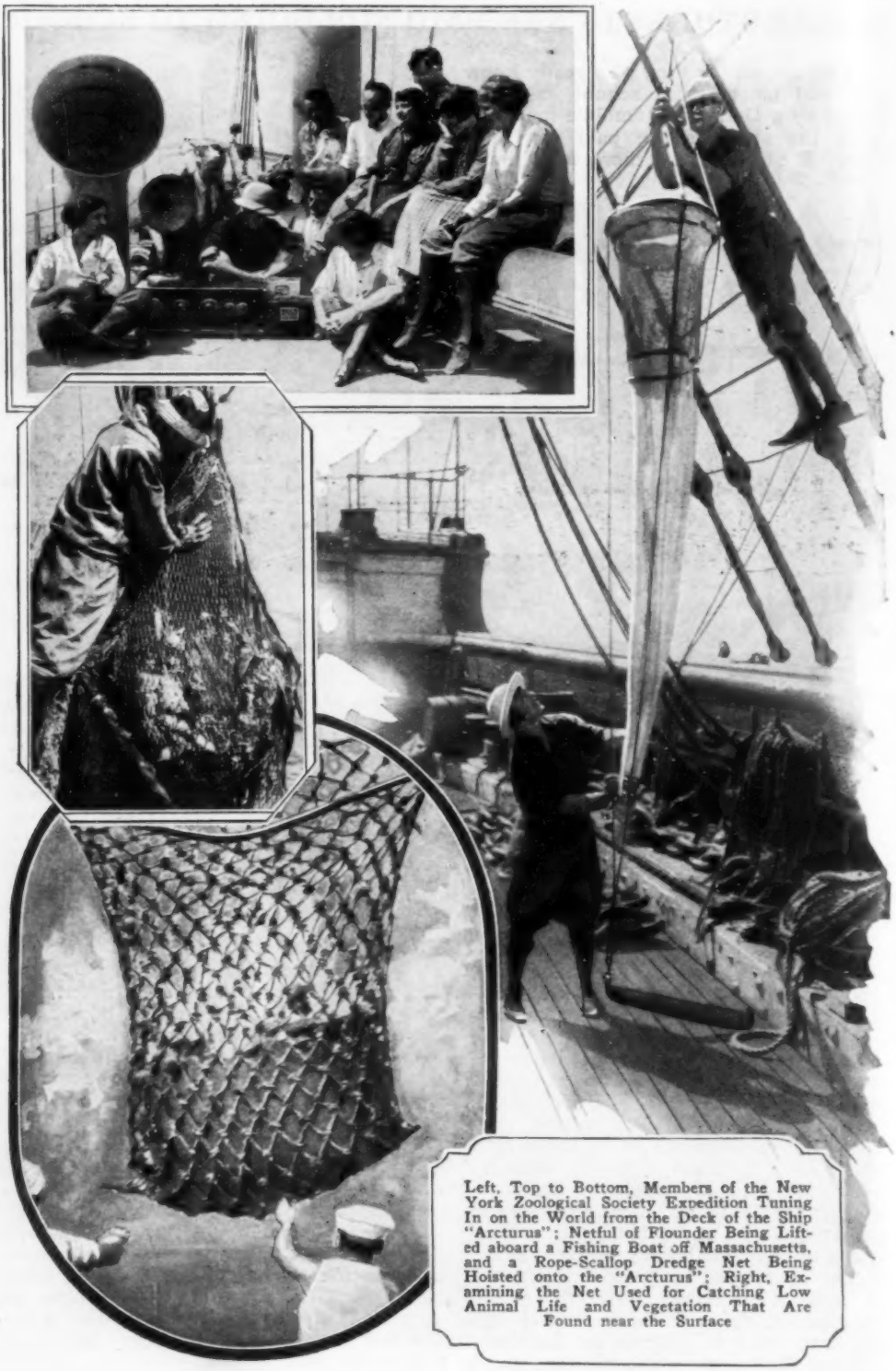
Flexible vestibules, somewhat like those on railroad trains, have appeared on street cars run in units of two in Chicago. This arrangement permits passengers to go from one car to the next in safety, particularly on curves, and the trailer combination has proved of value in saving time and relieving congestion on several routes. Springs outside the vestibule keep persons from riding on the truck.

Electric Train of Two Cars Connected by Flexible Vestibule

# WHERE STUDENTS ARE PAID FOR GOING TO SCHOOL

To fill a need for men who really know tools and machines, a school has been opened by a Detroit automobile maker in which the students are paid for their work. Because of the increase of mass production, where every individual is confined to a single operation, and where the men working at machines are not machinists, the old-time skilled craftsman is in greater demand than ever before and at higher wages. Boys from twelve to fifteen years of age are taken into the school and kept until they are eighteen. They come from families where they might have to leave school at these ages because of decreases in family incomes through the loss of parents or the coming of incurable illness. Among them are boys from China, Italy, Mexico and Russia, and each one is laying the foundation for an exceptionally good mechanical and general training. The boys are paid nineteen cents an hour for a forty-eight hour week in addition to the classroom and shop work which they are given as part of the schooling. In addition to this wage, the boy is paid for holidays, a three-weeks summer vacation, and two dollars a month goes to his credit in a personal saving fund. This money cannot be drawn out without the approval of the director of the school, and this is done in order that the student may be encouraged to save without taking any money out of his earnings, which in almost all cases have to aid in the support of a family. In the classrooms, the younger boys receive the same educational advantages they would have in public schools up to the eighth grade. After this, particular emphasis is laid on mechanical subjects, such as drawing, mathematics, physics or mechanics, a little metallurgy and some chemistry. Every job which the boys work on in the shop has a commercial use, and if the parts they have made pass the same rigid inspection as that to which articles made in the regular factory are subjected, they are purchased by the car maker.

Exterior of School Building, and Inside One of the Shops with Students at Work for Which They Receive Pay



Left, Top to Bottom, Members of the New York Zoological Society Expedition Tuning In on the World from the Deck of the Ship "Arcturus"; Netful of Flounder Being Lifted aboard a Fishing Boat off Massachusetts, and a Rope-Scallop Dredge Net Being Hoisted onto the "Arcturus"; Right, Examining the Net Used for Catching Low Animal Life and Vegetation That Are Found near the Surface

# HUNTING *the* TIGERS *of the* SEA

Remarkable Picture of 180-Pound Tarpon Throwing the Hook Free and Escaping after a Terrific Two-Hour Battle off the Florida Keys

SIX-FOOT shimmering tigers that live in the sea, terrible flesh eaters that will snap the leg off a swimmer or turn cannibal and attack their own kind, lend a thrill to fishing off the Florida reefs that is found almost nowhere else.

Game fish which will put up a battle royal when hooked with rod and line are plentiful, but fish which are dangerous to the fisher are few. The shark is a coward at heart and the natives of the tropics consider a knife sufficient protection against it.

But a barracuda will fight anywhere and anytime, and the daggerlike teeth of its powerful jaws make it one of the most dangerous denizens of the sea. Get one on a hook and you will soon realize that you are "up against" a being stronger than yourself. With feet braced and the reel screaming under the drag, you may fight the big fish until the flesh is worn off your hands and your whole body aches, perhaps only to see it break away and disappear after hours of struggle.

The barracuda is only one of a host of fighting fish which swarm among the Keys between the Gulf of Mexico and the Atlantic. Into their crystal-clear water huge roamers, some of them weighing many hundreds of pounds and capable of swimming at express-train speed, come to feed on the lesser finny tribes, or like the cannibal barracuda, attack each other. In one-half day a fishing party of three recently caught twenty-four fish. One was a huge barracuda, six feet in length, armed with cruel inch-and-a-quarter-long teeth that could have slashed a man half in two. It took the bait behind the launch and seemed like a sliver of snowy ice beneath the slightly greenish water. When hooked, it leaped five feet above the waves, its great body glistening like silver, as it hung for a moment suspended in mid-air, while the sun made a rainbow of the spray. In twenty minutes it was worked close to the launch, with three or four of its fellows following close. They seemed to sense that the hooked fish was in distress. Another baited hook was thrown out, one of the barracudas took it, and both were held near the launch, for there were many amberjacks on the reef, and as these fish are perhaps the most curious in the world, the fishermen had little doubt that soon they would have some of them up near the surface to find out what it was all about.

Like a flash they made their appearance. Great thick-bodied hump-backed fish, gleaming in bronze and gold under the tiny wavelets, three or four feet long. One of the barracudas was pulled in and fresh bait cast out. An amberjack took it. "Zip, zee," sang the reel as it made a

slanting dive for the bottom, hunting the holes in the rocks where it makes its home. The fisherman put the drag on the reel, and the beads of sweat broke from his face as he fought the hard-bitted jack. Down in the flickering depths appeared a great form that looked as large as a cow. It came slowly out of the dark reflection above a black rock into the clear water above a white patch of sand and seaweed. There it hung suspended, apparently watching the big jack that was fighting for the bottom. It was a monster in size. But then, the ocean was alive with fish. From everywhere they seemed to have come attracted by the killing. Everywhere was motion of fish and water. Only this great black form remained inert.

"Wow, what a whopper," cried one of the party. "It's a jewfish. I'll bet he weighs 300 pounds."

A piece of cut bait was thrown in front of the vast form, which now was almost directly beneath the side of the launch. But the great creature—formed like a black bass of Brobdignagian proportions—flapped its tail and slowly disappeared. It wouldn't take cut bait.

Huge Sailfish Caught off Coast of Florida; These Undersea Express Trains, Traveling at Enormous Speed, Are Most Prized Catch in Southern Waters

Quaintest, strangest, swiftest, most curious of habit, and most sought for of all game fish in southern water is the sailfish. It is only within the last twenty years that people have understood how to catch it, and even today very little is known of its habits. No one knows where they breed. Along the beginning of March and to the end of April the fish are seen swimming in pairs, and sometimes in threes or more, toward the south. The belief is that they work their way far off and spawn in the deep sea, where their young remain until sufficiently grown to elude their enemies. The smallest sailfish ever officially landed on rod and reel in the Gulf stream off the Florida coast weighed five and one-half pounds and the next smallest is said to have weighed about eight pounds.

Imagine catching a fish that can swim at the rate of seventy miles an hour, that can leap over thirty feet of water, and that has been known to make thirty-two successive leaps, and you will have some idea of the thrill of landing one of these crested monsters. That does not conclude the sailfish's accomplishments. It has been known to "walk the water" on its tail for a distance of 175 feet. The entire body is kept out of water and pitched at an angle of about forty-five degrees to the surface. Only the tail remains in the water, as the sailfish lashes itself over the surface, shaking the whole body from side to side, and wagging and throwing its huge head with violent jerks, as in a frenzy of rage and terror it endeavors to cast the hooks from its mouth.

The sailfish jumps when it is first hooked and fresh. If it walks the water, it is usually after it has jumped. It may take out 300 feet of line in less than three seconds, and then leap in front of another launch 500 feet away. The weight of the wet line makes a heavy drag on it. Yet fishermen are careful not to let it get all the line, for if it ever does, it is gone. There is not a stranger or more beautiful-looking game fish. Its enormous crest or sail, which is really a huge fin, is of the loveliest ultramarine blue spotted with great purple blotches. This

Nine-Foot Shark, Turning on Its Back in a Spinning Effort to Break the Heavy Manila Rope Which Carries the Huge Hook with Which This Sea Terror Was Caught

sail folds at will into a deep black-lined groove on the top of the back and is directly connected with the spinal column. When a sailfish begins to get tired—sometimes it fights so bravely that it is brought to the side of the boat practically dead—it usually "lowers sail."

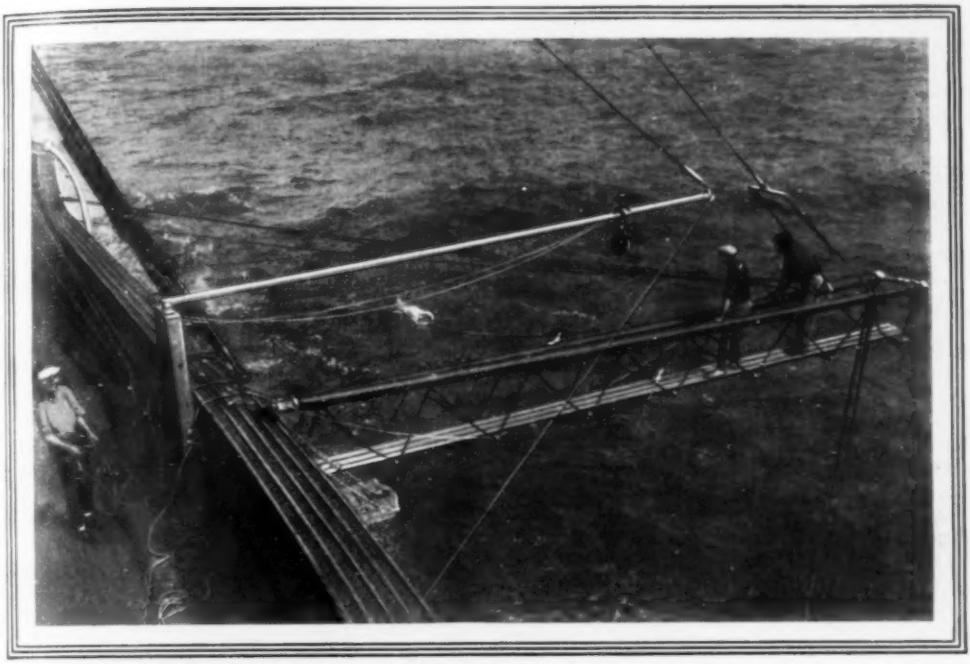
In the spring these fish are seen off the reefs where they hunt for food by the hundreds. As many as thirty-seven, a world's record, have been caught, and liberated, in a single day near Long Key.

Its back is colored with the deep blue of the Gulf stream. The belly is shimmering silver. Underneath, near the throat, are two streamerlike fins, that also fold into grooves. The tail is swallowlike, of the mackerel type, for the sailfish occupies a position midway between the mackerel and swordfish groups, according to Dr. E. W. Gudger of the American Museum of Natural History. Its bill, or pike, is a long rounded spear roughly covered, like a deer's horns when it is "in the velvet." Before the sailfish seizes the small fish on which it preys, it raps it with the bill. Sometimes it will follow the bait trailed behind the launch for ten minutes and rap it several times before finally seizing it or turning away. The sailfish moves with lightning rapidity. The fisherman's contest with it calls for finesse. It is the skill of the rapier thrust rather than the bludgeon stroke that lands it.

If you ask how fast a sailfish can swim, the answer is that it can swim as fast, if not faster, than a dolphin, not the porpoise, which is a warm-blooded mammal,

Top, Balloon Fish, from Hawaii, Which Displays Anger by Swelling Its Body, and a White, Tentacled Sea Cucumber; in Circle, Curious Sea Vegetation Photographed in the Depths of the Sargasso Sea by Scientists Accompanying Dr. William Beebe on the "Arcturus" Trip

Left, Businesslike Set of Teeth of the Monkfish, Another Deep-Sea Curiosity; Right, the Porcupine Fish, a Rare Specimen Recently Added to a Private Aquarium, and above It, Sheep Fish Caught off San Francisco (© U. & U.)



Hauling in the Deep-Sea Specimen Net on the "Arcturus" during Her Cruise through the Mysterious Sargasso Sea in Search of New Forms of Marine Life

but the wonderful amethystine fish whose greens and golds and purples, turquoise, blue, silver, and black and opal, blend into a riot of metallic colors that can never be described because the skin of the living dolphin seems to reflect light like a prism, and give forth changed hues if you view it from a slightly different angle.

You never know what sort of fish you will catch in these iridescent waters. You may hook one sort and land another. A. F. Meisselbach of Little Silver, N. J., once had a strike from a big sailfish. He yanked it hard and set the hook. He played the fish for half an hour, and worked it near the launch, when it seemed to be ready to give up the fight. Suddenly Meisselbach felt a tremendous tug on the line, and thought his sailfish was making a last effort. Then the line went slack. Another tremendous tug, and Meisselbach found he had a twelve-foot shark on his line. At last he landed it, and towed it to shore behind the launch. An autopsy disclosed that the shark had eaten the sailfish in installments. The head with the hook was deep in the shark's throat, and there were two big hunks of sailfish in the stomach. The tugs on the line occurred when the shark took its bites.

On a pound-for-pound basis, the shark is not to be compared in savage voraciousness with the barracuda. This formidable fish reaches a length of six feet and a weight of fifty-seven pounds in these waters, though on the west coast of Africa, in the gulf of Guinea and off the north coast of South America it is said to reach eight or ten feet. It rushes at the bait as soon as it is cast over the side. It is so voracious that it is no trick to hook it, but it will make a splendid fight, often hurling its long heavy body far from the sea. When first caught it is silver-white, gleaming in a thousand changing metallic hues. Its teeth, large as the fangs of a gray wolf, are snow-white. Compared with a small barracuda, a muskellunge of equal weight is not in it for strength, ferocity and endurance. The barracuda breeds in these waters and is very prolific. There must be millions of them in an area of a few hundred miles along the coast. As many as 500 in a single group have been seen attacking a school of mackerel.

Sometimes the amberjack fights in company with barracuda in attacking other fish, or it may be just a coincidence that the two marauders are found together. But they will hang on a school of fish like wolves on the fringe of a drove of cows with calves.

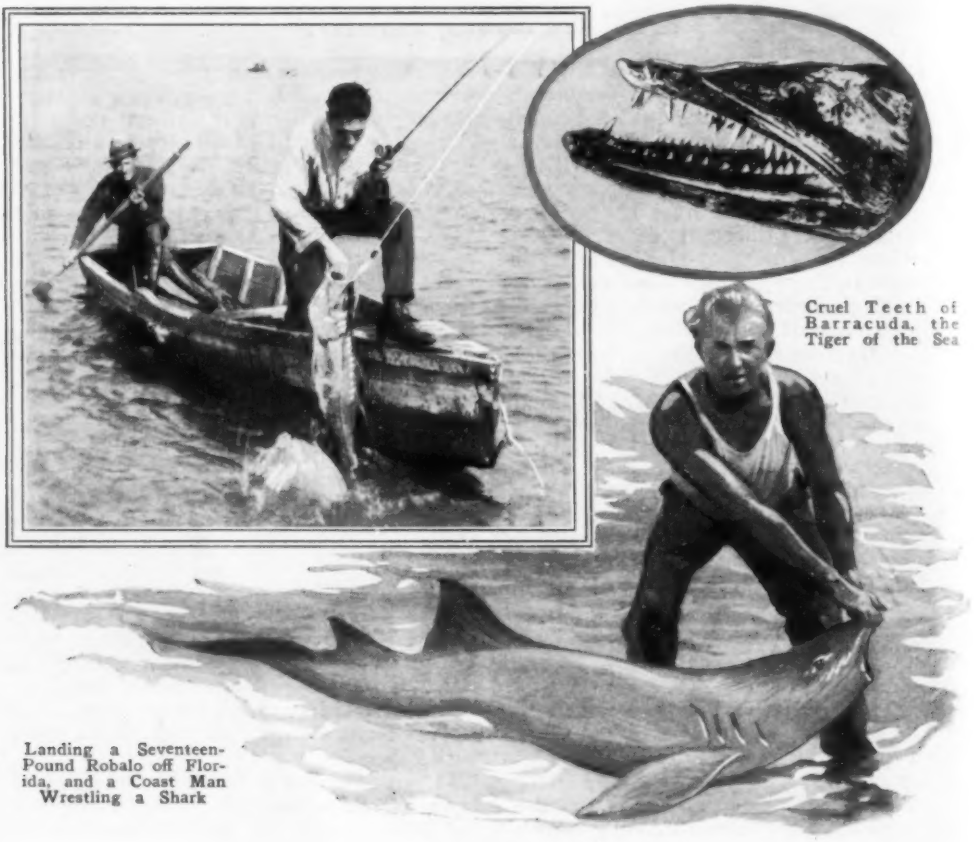
If you call the barracuda the tiger of the seas, the amberjack certainly deserves the title of the bulldog of semitropical

waters. Its jaws have a tremendous grip and it can crush shellfish in its hard, bony, toothless mouth. In fact, it hunts along the reefs and hides in the crevices of the rocks at the bottom. When hooked, it makes for these crevices, bores down as deep as it can and wags its big head from side to side like a dog wrestling with a rag, sending a thrilling code to the fisherman at the other end of the line. It is a masterhand at getting under a boat, and if it ever does, good by! It has the line frayed in two in a second. It is a wonderful experience to see one of these great fish at the end of your line, beneath the water, as a thrilling battle draws to its close. You see the first faint gleam of the fish far under the water. Then a rush, perhaps, and you are startled to find the great thing you have been fighting outlined sharply in the clear ocean, still seeming wild and not within your grasp. And he may not be, at that. You do not know at what moment the faint yellow outline far in the depths, that you know to be a shark following your fish may come up and seize it. And how desperately it struggles when a shark approaches it.

The cleverest of all fish in throwing the hook is the tarpon. It has more tricks to get rid of it than any other of the great game fish. It has been known to extend its gills, wag the giant head and cast a hook fifty feet. The tarpon is a giant herring. Commercial fishermen report having seen thousands at a time in the passes between the Gulf and the Atlantic. Today you can see a hundred most any day, if you are lucky.

Just a word about the marlin swordfish, a great chap that is beginning to be caught in the Keys. It is known to get up to 400 or 500 pounds and more. It raps the bait like a sailfish, and save that it is a larger, stronger fish, offers all the sport given by "His crested Majesty of the Gulf stream." At first glance it looks like a sailfish with a reduced sail.

There are millions of gamy fish in the Florida Keys, and, it is believed, there always will be, for nets are not allowed, nor could they be used in these rock and coral-infested waters.



Cruel Teeth of Barracuda, the Tiger of the Sea

Landing a Seventeen-Pound Robalo off Florida, and a Coast Man Wrestling a Shark

# WORLD MAP OF ALUMINUM THIRTY-FIVE FEET LONG

Huge Aluminum Relief Map of World with Ribbons Indicating Passenger Lines

Routes of the shipping board's twenty-three cargo and three passenger lines are graphically shown by ribbons stretched across a huge aluminum relief map of the world, fifteen feet high by thirty-five feet long. Time divisions are shown at the top so that a glance tells the hour in different parts of the world. The metal is placed upon the framework in sections and was cast from an original in wax prepared by the navy department.

## GRIP ON SCREWDRIVER BLADE HOLDS NUTS IN PLACE

Holding nuts and screws in places where space is cramped is simplified with a screwdriver that has a gripping attachment which slides upon the blade of the tool where it is held by a setscrew. The attachment has two jaws that extend just beyond the end, so that they can be placed about the head of a screw or a nut and locked while either is being started. When not in use the gripper is slid up toward the handle. The latter is made of a rubber composition, which is said to furnish insulation against voltages up to 2,200 and to be unbreakable.

Driver with Spring Grip, Holding Screw in Place Until It Can Be Started

## STORIES OF BIG HAILSTONES SUPPORTED BY RECORDS

While hailstones as big as eggs are considered of unusual size, the department of agriculture, in examining weather records has discovered several instances in which the ice particles weighed more than a pound each, and at least one where they were reported to have weighed four and one-half pounds. On April 17, 1874, in Natal, hailstones weighing a pound and a half perforated corrugated-iron roofs, and in New South Wales, in 1847, stones fourteen inches in circumference fell during a storm. The fall of four and one-half pound hailstones was reported in Cazorla, Spain, on July 15, 1829, and in a storm almost as destructive at Cette, France, when houses were wrecked and ships sunk.

Coolidge's Father Inspecting Cabinet the President Made When He Was Ten Years Old

## CABINET MADE BY COOLIDGE WHEN TEN YEARS OLD

That President Coolidge, when a boy, possessed much skill at making things with his hands, is shown by a miniature cabinet he constructed when ten years old. Manual training was not taught in the schools in those days, but in spite of a lack of coaching or instruction, young Calvin managed to build a creditable piece of furniture which today, after nearly fifty years, is still in good condition and is one of the prized possessions of the Vermont homestead.

## COMBINED SCOOTER-CYCLE FOR SIDEWALK USE

Combining the features of an ordinary bicycle and a scooter, a child's vehicle now on the market may be operated safely on the sidewalks, keeping the riders away from street perils. It is propelled either by a pedal and sprocket-chain drive, or may be pushed along with one foot while standing upon a lower cross brace with the other. A comfortable seat, rubber tires and a brake, worked from the handlebars, are features. The vehicle is so low that learning to ride it as a bicycle has fewer hazards than with those of regular size.

Scooter and Bicycle in One Can Be Used on Sidewalks and Has Rubber Tires

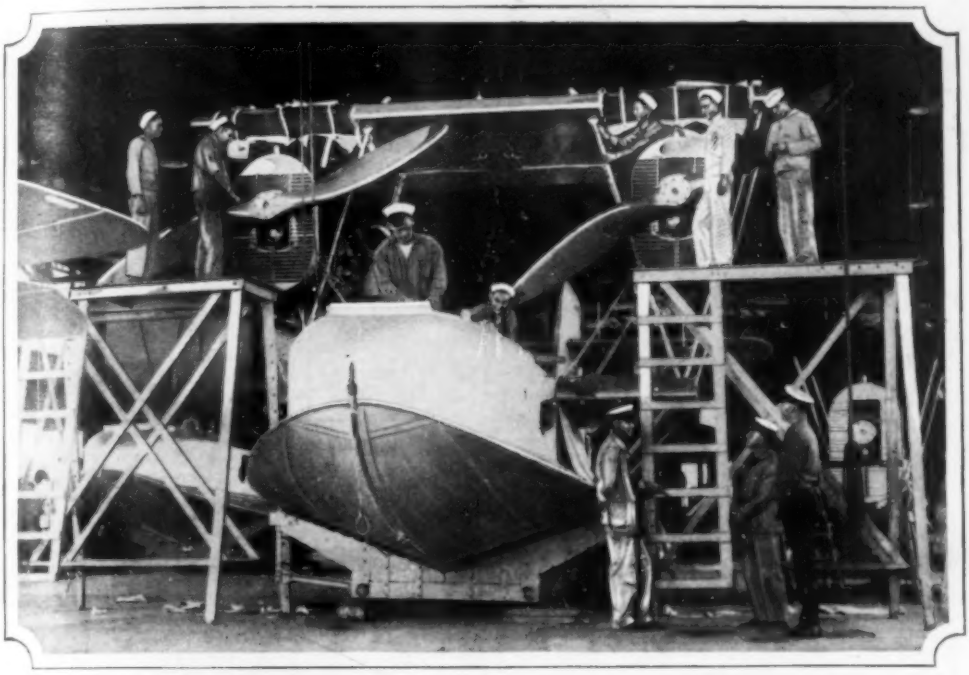
## MAN-MADE HURRICANE TO FREE TUNNEL OF AUTO GAS

Approved plans for the ventilation system of the two-mile tunnel under the Hudson river, which will have an estimated traffic of 46,000 cars a day, provide for a number of huge electric fans for forcing a seventy-five-mile wind through an airway under the road to rid the passage of exhaust gases. Used air will be sucked out through ceiling vents, set every thirty feet, into another large airway, so that there will be a continual current of air at every point in the tunnel. The intake and outlet flues and the ventilating apparatus will be contained in four large plants, two on each side of the river. The system was tested in a mine, where touring cars and trucks were operated under various conditions. A special operating feature of the auto tunnel will be the order to "stop all motors" at the command of traffic policemen who will be stationed along the tube.

## WOMEN MOTOR DRIVERS EQUAL MEN IN SKILL

Women automobile drivers have just as much ability as men, if not more, says a report, prepared by the American automobile association, on a series of tests. From the experiments, the conclusion was drawn that women are no more likely to lose their heads than men, and that there is no reason why they should be more emotional. Students were selected for two of the most important tests, one that measured quickness of reaction to a dangerous situation and the other, consistency of response. The average reaction time for the ten college women tested was .56 second, while that of twenty-five men was .59 second. Women have also been thought more variable than men, but this too was contradicted by the consistency tests in which the women showed a mean variation of only .17 second, while the men averaged not less than .22 second.

# TEN-TON PLANE BUILT FOR LONG SEA TRIPS



Latest Navy Plane, Especially Designed for Long Ocean Voyages, Has Wings Seventy-Two Feet Across, and Is Said to Be Seaworthy Even When Alighting on the Roughest Waves

Weighing nearly ten tons and with a wingspread greater than the width of a city lot, the new navy plane developed for the coast-to-Hawaii dash is equipped with a keel which makes it seaworthy in the heaviest waves, it is claimed. The ship, known as type PN-9, has a wingspread of 72 feet, weighs 19,500 pounds and can carry 1,350 gallons of gasoline. Expert officers and enlisted men of the navy assembled the giant man-made bird at the air station in San Diego, California.

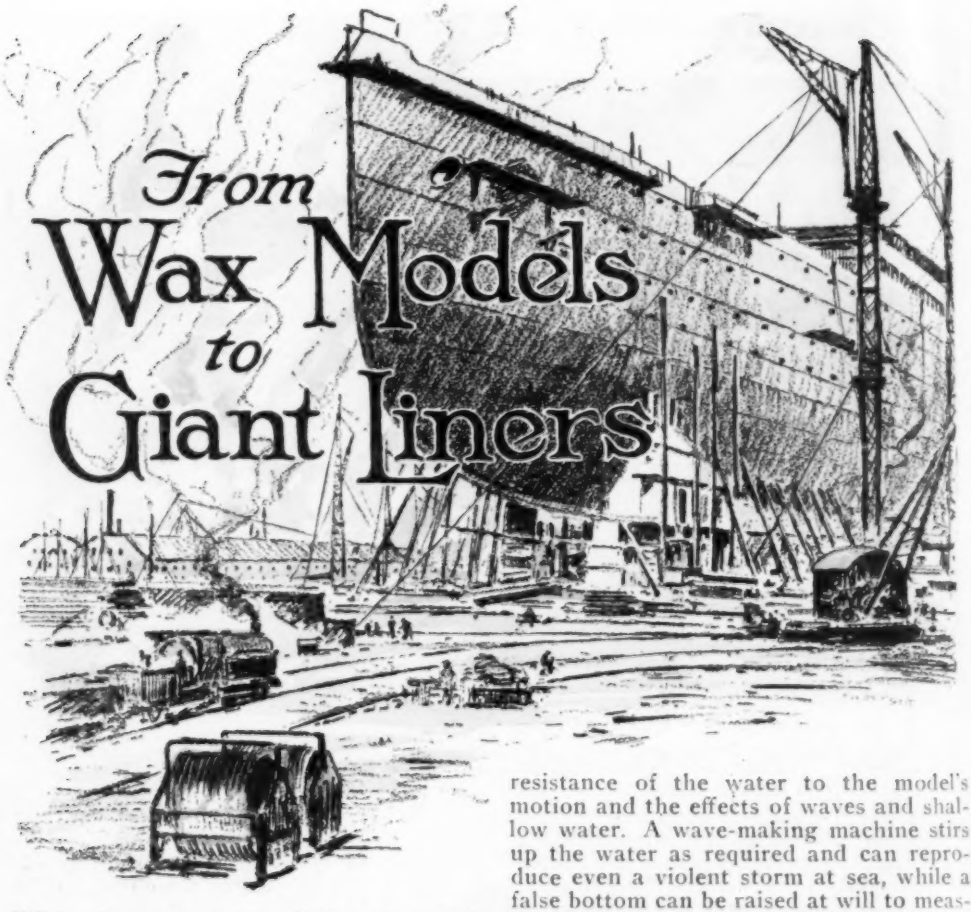
## WEIGHING A SUNBEAM

Like a jet of water, a beam of light pushes against any obstacle placed in its path, and though the force is extremely minute, it has been measured by scientists. A delicate fiber of quartz is used for this purpose from which is hung a small, vertical rod with two shorter pieces at the lower end. These, in turn, carry disks of thin metal, two of them blackened and two polished. The apparatus is in reality a fine balance, and in the measurements, is placed under a glass covering from which all the air has been exhausted. The beam of light is first directed upon the blackened disks. Its force causes the quartz fiber to twist. The movement is measured by means of a small mirror attached to the apparatus which reflects a spot of light upon a fixed scale.

## THERMOSTAT FOR AUTO MOTOR KEEPS TEMPERATURE EVEN

To bring the engine temperature to the most efficient point in the shortest time, a thermostat now on the market is said to operate effectively under all weather conditions and eliminate the need for radiator coverings. It is connected to the water line, and works at the same adjustment for hot or cold weather and at different speeds and loads. It is said to reduce crankcase dilution and water in the lubricating oil, thereby saving fuel and affording better operation.

# From Wax Models to Giant Liners



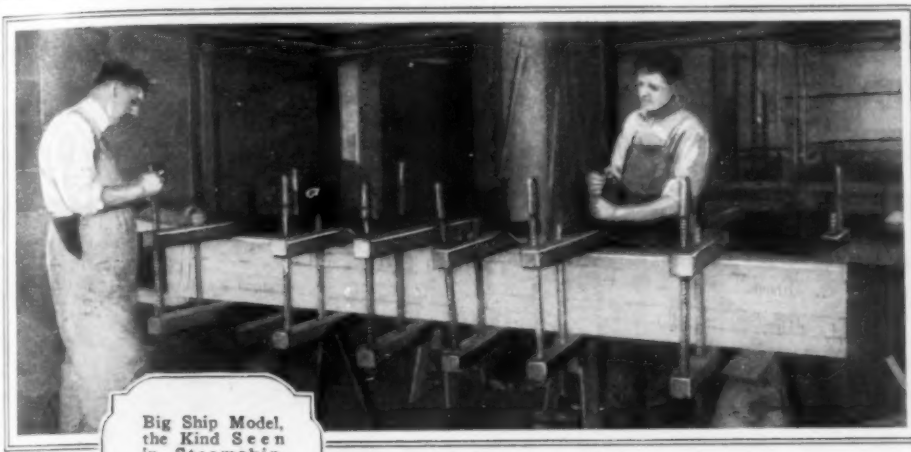
IT is a long step from a little wax-coated ship model, towed along through a shallow tank hardly big enough to float a canal boat, to a giant ocean liner plowing through the seven seas. But without the toy model, the designer would be unable to tell in advance how the future liner will perform in storm or calm, or its speed in the open sea or the shallow waters of rivers and harbors.

Ships built for the United States navy have been tested in advance through models in the towing basin at Washington navy yard, but in recent years the same practice has been followed to gather data on hull lines for merchant vessels. At Teddington, Eng., a concrete tank, 550 feet long, thirty feet wide and twelve and a half feet deep, was built several years ago to carry on the experimental work.

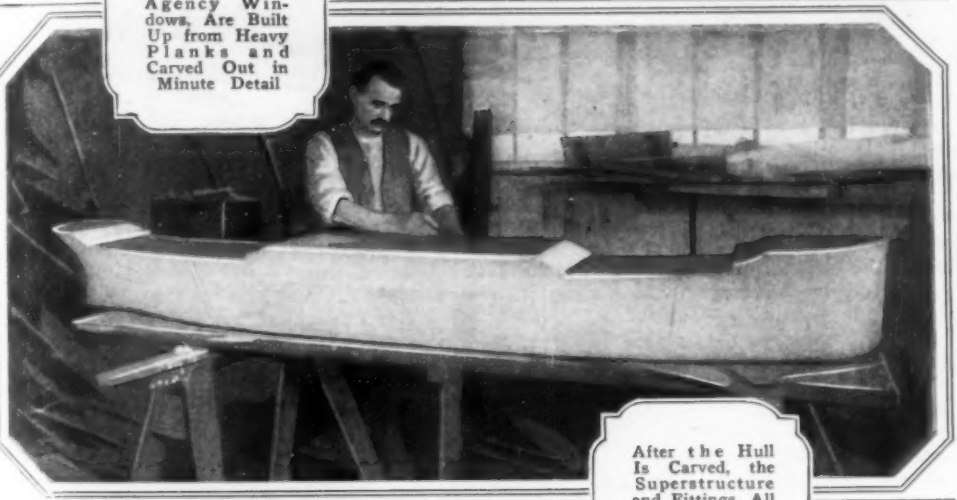
The hull designs are built up out of wax and then hitched to an electrically propelled carriage, which spans the tank and moves at a uniform rate. It carries the scientific instruments used to measure the resistance of the water to the model's motion and the effects of waves and shallow water. A wave-making machine stirs up the water as required and can reproduce even a violent storm at sea, while a false bottom can be raised at will to measure the retarding effect of shallow water.

By making the models of wax, it is possible to alter the lines to try out effects of slight variations. The whole series of tests, including the building of the model, can be completed within a week, the results showing resistances over a wide range of speeds and the horsepower required to drive the ship at the desired speed at sea.

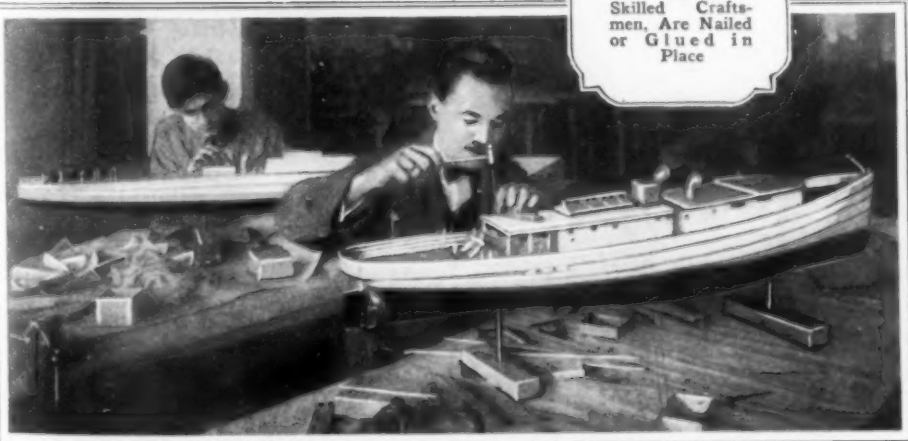
Methods of shipbuilding and designing are constantly changing, one of the latest developments having saved six months in the building of a big passenger liner on the Great Lakes. Instead of waiting until the hull was completed and launched to start on the superstructure, as is the usual practice, the carpenters and joiners began this work at their plant at the same time the keel was being laid at another. The parts of cabins, social hall, galley, dining rooms, and other accommodations were cut, fitted and then bundled up and laid away, each piece being carefully numbered according to the blueprints.



Big Ship Model, the Kind Seen in Steamship-Agency Windows, Are Built Up from Heavy Planks and Carved Out in Minute Detail



After the Hull Is Carved, the Superstructure and Fittings, All the Work of Skilled Craftsmen, Are Nailed or Glued in Place



The Launch of a Great Lakes Ore Freighter, Showing the 600-Foot Hull Sliding Sideways into the Water

When the hull was completed, engines installed and the whole launched, it was towed to the finishing yard and the previously prepared superstructure erected. Another new departure was the construction, on land, of the complete pilot house. When the time came to install it, the room was lifted by a derrick and swung into place as one unit.

Ship construction has developed rapidly since during the war the fabricated vessel was invented, with its plates and beams cut and bent at steel mills and shipped to the yards, with rivet holes drilled for assembly. Unfortunately wholesale methods are only practical when large quantities of ships are to be built, and since the war there has been no occasion to try them out again.

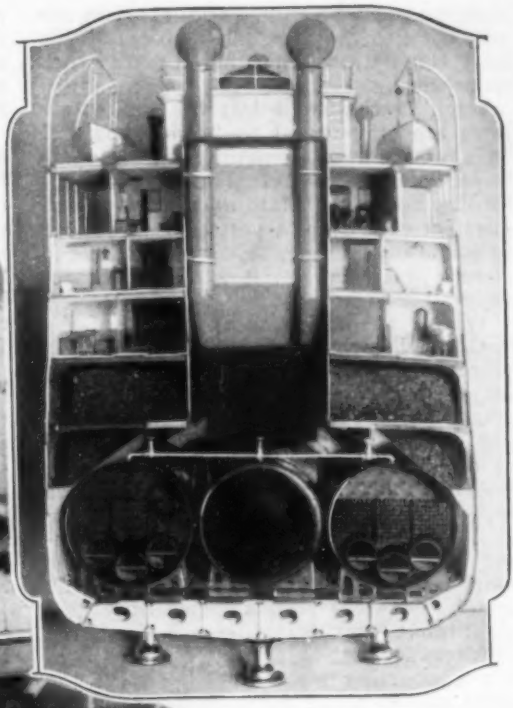
The ordinary process of building starts when the vessel has its conception in the brain of a naval architect. When he gets his assignment, he is told the kind of service the vessel is to be used for, whether wholly passenger or freight or both, and the part of the world it is to operate in. If it is to call at tropical ports, the arrangements are entirely different from those suitable in North Atlantic service, for the ventilation and refrigeration schemes will be entirely different. He also must know the possible ports of call to replenish fuel, water, stores and provisions.

When he has visualized the ship in his mind, he proceeds to set down on paper careful scale drawings, as a rule preparing three sets of plans. One is the general arrangement, showing passengers' cabins, cargo spaces and storerooms, machinery and fuel bunkers, ballast and fresh-water tanks, provision rooms, officers', engineers' and crews' quarters, and the navigating and victualing facilities, including galleys and dining rooms. The next plan shows the midship section, giving the various dimensions of steel work and materials to be used in construction. Finally comes the sheer draft, which includes three drawings, the sheer line, or broadside view of the vessel, with constructional details; the half-breadth plan, showing one-half of the ship as it will appear from above, and the body plan, showing the sections of the ship when looking from the end.

From the first drawings the model is built, if it is desired to test out the hull shape in the tank. On a hollow framework, approximating the outline of the ship, the soft wax is built up, hardened and then shaved down until an exact scale model is produced.

After the testing, draftsmen make the complete working drawings just as the architect produces blueprints for a house. These go to the mold loft, an immense low-roofed structure where a broad expanse of floor is painted to produce a horizontal blackboard. Here the lines of the ship are chalked out full size and "faired" by means of battens, or long, thin pieces of wood, keeping the full breadth and height, but contracting the length to insure fairness. The fairing gives correct figures for the curves by which plates and

Pilot House Being Lifted Aboard after Its Erection on Land



Cross-Sectional Model of Big Liner, Showing Midship Details from Keel to Boat Deck and Bridge

Hull Model Being Tested in the Towing Basin at Washington Navy Yard; This Is the Model for the High-Speed Boats of the Anti-Rum Navy

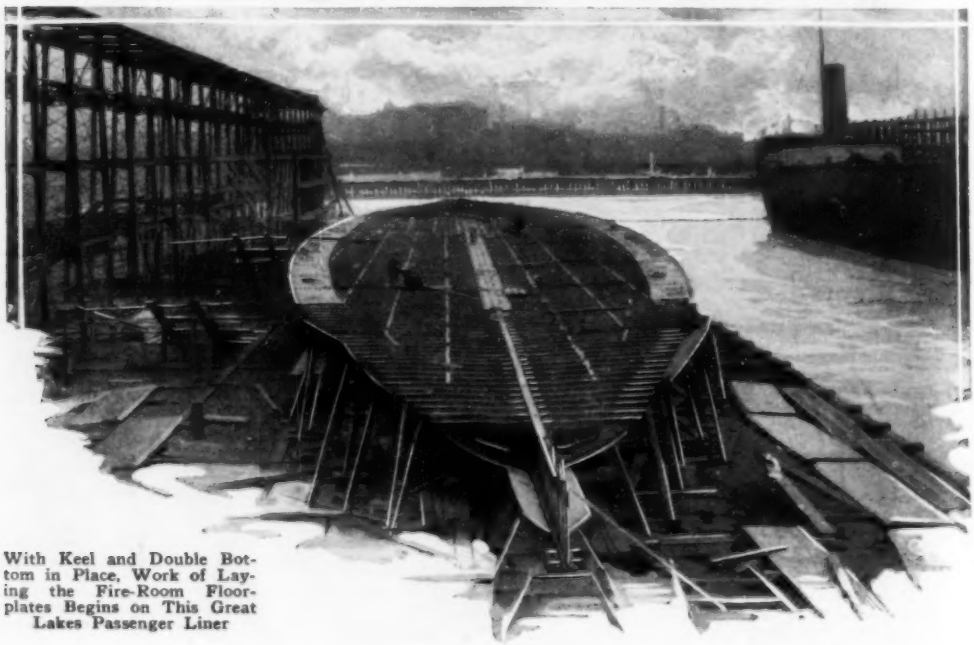
skeleton must be built, and these data are sent back to the designer, who makes his final calculations and then orders work to proceed.

Back in the mold loft the final body lines are transferred to "scrive boards," thin wooden, or sometimes paper, patterns, by which the actual bending is regulated. For every plate and frame which goes into the ship, a pattern is produced to guide its shaping. Every rivet hole is shown and every twist and curve carefully reproduced.

When the first steel, the parts of the keel, reaches the yard, keel blocks are in place for its erection. These blocks are huge timbers piled on top of each other, starting near the water line of the launching slip and rising gradually, at the rate of one-half inch to the foot, so that the hull when completed, can slide down them into the basin. As soon as the keel sections are riveted together, forming an immense flat girder the full length of the ship, work begins on the double bottom, which gives the ship a series of watertight tanks beneath its lowest deck. Large brackets are fitted along the outer ends of the connecting plates, in line with the floor, and to these are attached the steel frames which extend from the bilge tanks in the double bottom to the upper deck. The hull now takes form rapidly, the ribs are covered with steel plates, riveted into place, stem and stern are formed and decks laid. Boilers and engines are hoisted into place before the deck is placed over them, and finally the ship is ready for launching.

After this all that remains is the work of completing, furnishing and equipping the liner. The last item is an enormous task in itself. A new vessel, the "Malolo," designed by William Francis Gibbs, who made the plans for reconditioning the "Leviathan," requires thirty-two acres of linen for tablecloths, napkins, sheets and towels alone. The ship, being built at Philadelphia, is 582 feet long, has a displacement of 22,050 tons and a cruising speed of twenty-two knots, or over twenty-five miles an hour, making her the fastest big passenger ship ever built in the United States. She is expected to cut two days from the round-trip schedule between San Francisco and Honolulu. Besides her vast linen supply, her equipment includes 96,000 pieces of china and glassware, and 27,000 pieces of silverware.

Her ovens and ranges will cook by electricity, she will have more bathrooms than any ship ever built, and her water pumps will handle enough water each day to supply a city of 1,936,000 inhabitants. The comforts of the "Malolo" will set a new record for ships, including suites de luxe with private verandas, children's playgrounds, and a swimming pool.



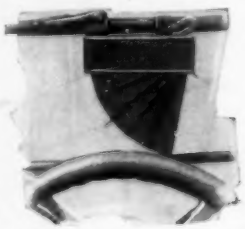
**With Keel and Double Bottom in Place, Work of Laying the Fire-Room Floorplates Begins on This Great Lakes Passenger Liner**

## OIL ENGINE BRINGS NEW ERA IN RIVER TRAFFIC

What amounts to a revolution in the methods of transportation on inland waterways is promised by the advent of crude-oil internal-combustion motors of the Diesel type. These motors are like those used in automobiles except that the charge in the cylinders is ignited by the heat of the compression and not by an electric spark. Not only is the operating cost of the oil engines much lower, but fewer men are required to run them. The government fleet on the Mississippi river is composed of steam-propelled craft. These boats represent the most modern ideas in towboat construction, but they still fall short of the ideal in that the cost of operation is too close to their earning capacity. If that margin can be widened by the use of Diesel engines, through greater power at lower cost, river traffic is expected to witness a great revival. The largest boat of this type yet built was expected to go into service on the Ohio river about October 1. It is 126 feet long and will handle a tow of about 6,000 tons at five miles an hour.

## FAN-SHAPED GLARE PROTECTOR FITS WINDSHIELD MIRROR

Auto windshield mirror for watching traffic behind and a glare protector have been combined in one adjustable unit that may easily be fitted to the most convenient position for the driver. The shade opens up and closes like a fan by pulling a little catch. It is made of green-celluloid segments, linked together to spread out over a sufficiently wide area to protect the eyes without cutting off the view.



## BUILDING BLOCKS LIKE BOOKS ADD TO CHILDREN'S FUN

Hinged building blocks that open up like books and are lettered and printed in gay colors, afford the child the double pleasure of reading and looking at pictures and making things at the same time. They may be washed without damaging the colors, are adapted to a wide variety of objects, such as towers, houses, bridges, churches and airplanes, and when not in use, fit in a box or on library shelves.

Building with Book Blocks That Open Out on Hinged Sides and Are Decorated with Pictures and Stories

## PROCESS FOR TEMPERING LEAD TO IMPROVE TELEPHONE

Increased life of telephone cables is one of the benefits anticipated from a recently discovered process for tempering lead, an objective of science for hundreds of years. The method involves a special heating treatment and the use of alloys. The product is said to possess some of the qualities of steel, making lead pipe so rigid that it cannot be bent by hand and greatly improving the coating placed over telephone cables.

# Where Brain and Skill of Desert Tribesmen

Abd-el-Krim, Leader of the Riffs; French Artillery Attack

Warring as Savagely as Did the American Indian of Old, the Fearless Riff Horsemen Discounted the Science of Both Their French and Spanish Adversaries in Desert and Mountain Fighting

# Discounted the Science of Modern Warfare

American Flyers Enlisted to Fight These Desert Rough Riders

Above, French Officers Are Watching Riffs Drive Back French and Spanish Troops Not Far from Fez, Chief City of Morocco; Right, Moroccan Chief Who Sided with the Europeans through Fear of Abd-el-Krim

## AIR-FILLED CUSHION HEADREST GIVES TRAVELER COMFORT

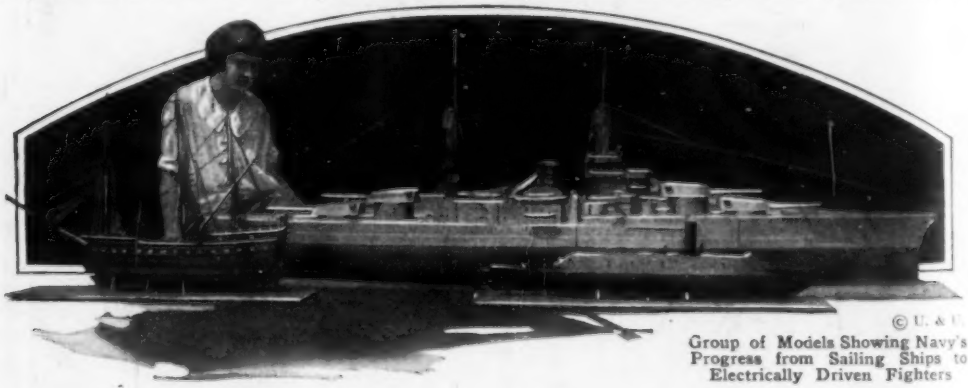
For the autoist, steamer traveler or invalid, an air-inflated rest for the head and

Air-Inflated Cushion in Use in Auto; Straps Keep It from Slipping Down

shoulders, is tied with tapes about the waist to prevent it from slipping out of position. When it is not in use, it is deflated and may be folded into small space. It is strongly constructed in colored and figured materials to match costumes or furniture.

## MODELS SHOW NAVY'S GROWTH FROM MASTS TO MOTORS

Development of the United States navy from the days of the picturesque sailing ships to modern times with their electric-driven steel-clad fighting monsters, is graphically shown in an exhibit of models in the National Museum at Washington. Included in the display, is a tiny replica of the "Bonhomme Richard," John Paul Jones' famous flagship, one of the "Merrimac," first of the ironclads, and a model of the "New Mexico," one of the latest additions to the navy.



© U. & U.

Group of Models Showing Navy's Progress from Sailing Ships to Electrically Driven Fighters

## AUTO-HORN CODE SIGNALS USED TO HELP END ACCIDENTS

"Horn talk" by which autoists may communicate with each other on the road is being taught to members of a large automobile association through a copyrighted code. Its purpose is to help end accidents and to promote mutual assistance among drivers. Based on the Morse code, the signal system comprises most of the things necessary to say on the road. One long blast of the horn means "Please let me pass." A short blast, equivalent to the telegraphers' dash, means "Thank you." A dot and dash mean "You are exceeding the speed limit." Dash-dot-dash-dot signifies "Can I assist you?" Four dots stand for "How do you do?" Two dots mean "OK." Three dots say "Please stop. I want information." The SOS of the broad highway goes like this on the motor horn: ". . . — — — . . .".

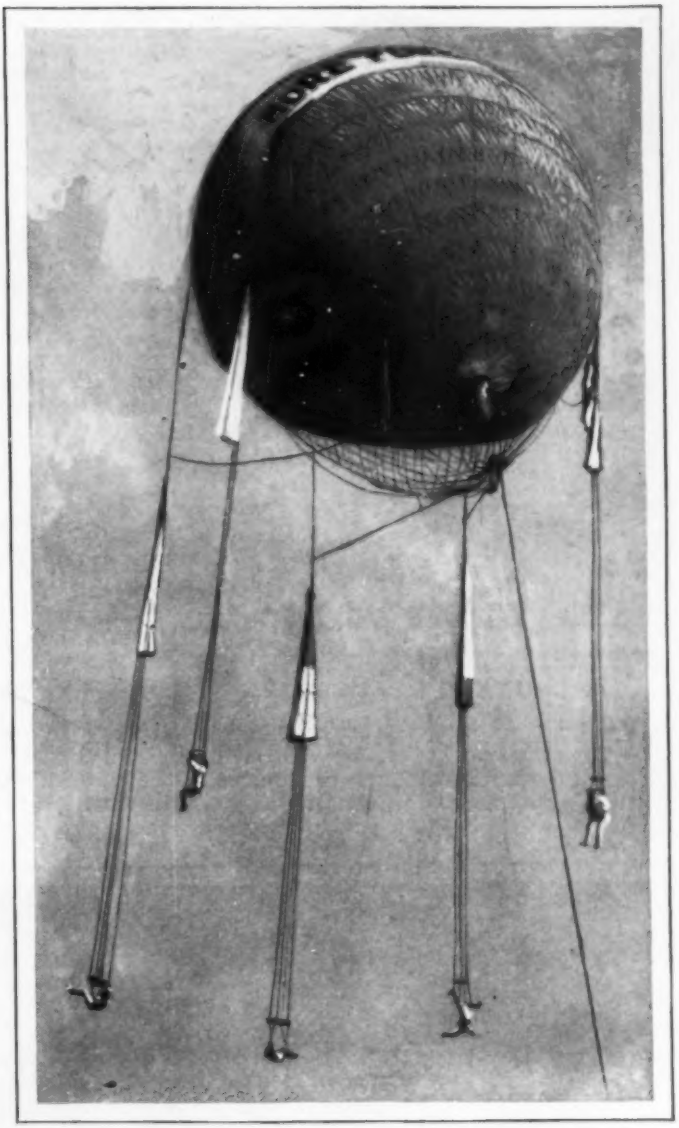
## MOST DANGEROUS AGES SHOWN BY ACCIDENT REPORTS

A child between five and nine years old is more likely to be struck by an automobile than at any other age until reaching sixty and above, according to a National Safety council's analysis of figures from the census bureau. The same report shows that the greatest risk from drowning occurs at an age of between fifteen and nineteen years, the most active swimming ages. Babies of one also show a high mortality rate from drowning and

this was held to reflect the hazard of allowing a toddling child to venture unwatched among washtubs and near creeks. A large number of deaths from scalds and burns was noted at the ages of two and three, the survey showing 37.3 per 100,000 infants in those age groups. The total declines rapidly after four and does not rise greatly until seventy, when many of the perils of childhood again are a menace. Death from falls and from asphyxiation as well as from autos and burns indicated the hazards of old age. Falls alone caused 552 deaths per 100,000 persons at the age of eighty and over. The report shows that they are, by far, the most important accident hazard for the aged. Firearms take their greatest toll at about high-school age, illustrating the risk of allowing inexperienced persons to handle them. Deaths from poisoning are most numerous among babies one year old, and mechanical suffocation, that is, by pillows, blankets and the like, is almost wholly confined to infants less than one year of age.

## NEPTUNE'S DRUG STORE

Elements in enormous quantities are held in solution in the waters of the ocean. Scientists have estimated that, although iodine exists in the sea to the extent of only two parts to 1,000,000, there are 60,000,000,000 tons of it in the oceans. Its extraction would bring approximately $540,000,000,000,000 at present prices. California produces 250,000 tons of common salt each year from the sea water. About a quarter of a pound of the mineral is contained in each gallon. Bromine in limited quantities is also being obtained from the sea.



Cluster of Daring Parachute Jumpers Hanging from Balloon Just Before Strings Were Pulled and Men Dropped 3,000 Feet

## FIVE PARACHUTE JUMPERS RACE FROM SINGLE BALLOON

Dangling from a single balloon that carried them to an altitude of 3,000 feet, a team of five daring parachute jumpers dropped simultaneously during an exhibition in California, and all landed safely in the waters of a lake. The feat involved the careful adjustment of the rigging to prevent tangling of the ropes. During the ascent, the jumpers performed acrobatic stunts hanging by their hands or feet.

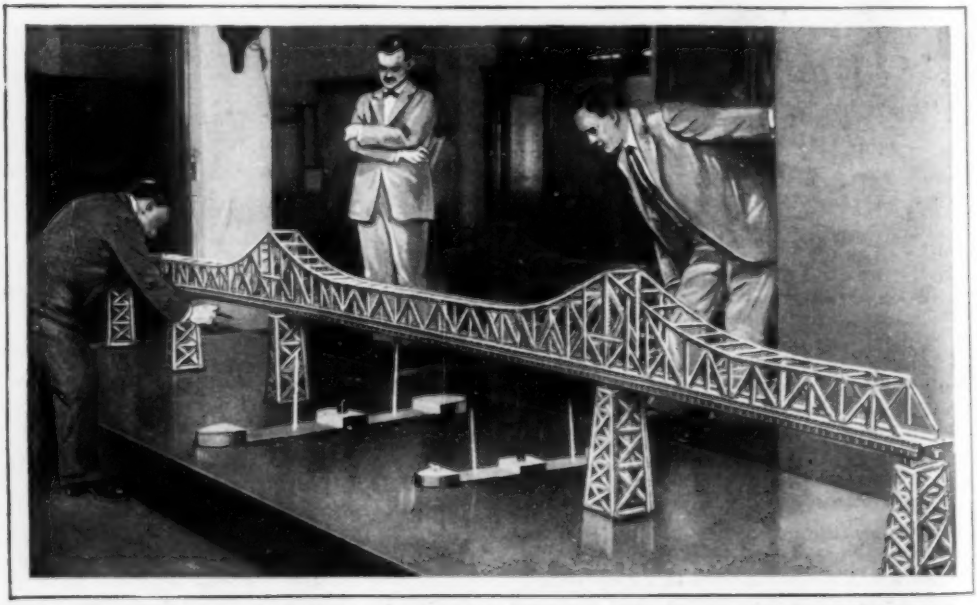
Using Meter Which Eliminates All Guessing as to Amount of Light Reaching Worker's Bench

## PORTABLE LIGHT METER GIVES ACCURATE READINGS

Weighing but three pounds including its batteries, an easily portable light meter has been devised for finding the intensity, location and distribution of light in factories. It also is used for matching colors in dye and paint making. A disk of white blotting paper is placed on the spot where the illumination is to be tested, as on a worker's bench. The operator looks through an eyepiece of the meter and sees two elliptical patterns, one within the other, produced by action of a glass cube within the tube of the instrument. The light reflected by the tested object passes straight through the glass cube and the telescope. But the light from a small lamp within the tube reaches the eye only after having been reflected at right angles. The operator moves the lamp in and out until the two ellipses seem to match in brightness. Graduations engraved on the side of the tube then give the intensity rating of the light.

## BRIDGE MODELS AID ENGINEERS PLAN REAL STRUCTURES

Small models of the proposed bridges between New Jersey and Staten Island, N. Y., were inspected by engineers to give them, and others interested in the project, an idea of the proportions of the structures, the length of spans and other details. The display was made more realistic by the use of mirrors to represent water and toy boats with sticks for masts which were placed under the bridge showing that it was high enough to afford vessels a clear passage.



New York Engineers Examining Models of Proposed Bridges between New Jersey and Staten Island; Mirrors Represent Water and Toy Ships, Built to Scale, Show Clearance under Spans

# Fighting Insects

THE immigration authorities at Ellis Island may be successful in barring from entry to the United States foreigners unable to fuse in the melting pot of American society, but at least three immigrants have sneaked in the back doors and, as parasites, are preying upon this country to the toll of approximately $325,000,000 annually.

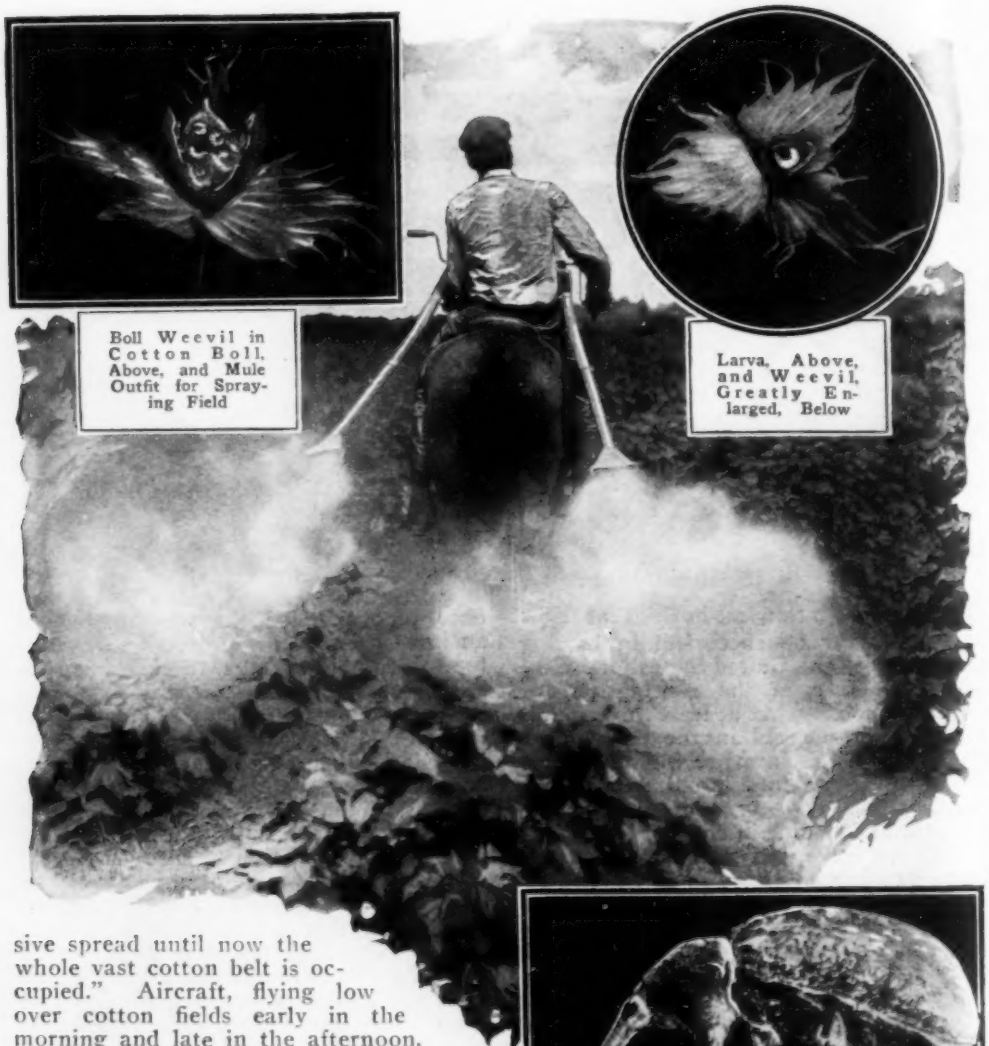
These undesirable immigrants—the boll weevil, the European corn borer and the Japanese beetle—have so intrenched themselves as to defy successfully all known methods of warfare. The militant attitude of these foreign foes, and others of their kind, is said to threaten civilization and to foreshadow the next war in the United States as one with bugs or insects instead of with human enemies.

This is not the prediction of an alarmist. Couched in different language, Dr. L. O. Howard, entomologist of the department of agriculture, has issued a warning of impending disaster unless organized warfare is made upon insects. Read the exact words of this authority who has been studying the subject for about sixty years:

"The prime insect pests of the world are, through commerce, becoming widespread, and the self-protection of nations demands the most intimate knowledge of the injurious insects of all countries, since all of them are potential pests of other regions. This subject was considered at some length at the recent Pan-Pacific Food Conservation congress, and one of the resolutions adopted at that conference recommended the appointment of an international crop-protection committee to promote surveys, to encourage research work, to promote the development by each country of larger numbers of trained workers, and to obtain agreements and understandings between countries regarding the giving of prompt notification of the appearance of new pests and to secure the co-operation of countries in the prevention of spread."

Thus we have the germ of what may be termed "The League of Nations against Bugs." If this organization had been functioning, probably the boll weevil would have been arrested in attempting to cross the boundary between Mexico and this country, and the shipments of broom corn from Hungary and Italy in 1909 and 1910 would have been fumigated before entering the United States, thus preventing the ravages of the European corn borer. Similarly, the Japanese beetle would not have gained entry into Pennsylvania, New Jersey and Delaware.

The boll weevil, arch enemy that it is, costs the United States $300,000,000 each year, or a toll of approximately $1,500,000,000 during the past five years. "Brought by accident, across the Rio Grande at Brownsville," relates the chief of the bureau of entomology, "and then more or less by accident to Alice, it found itself in a boll-weevil heaven—a whole state growing cotton in just the way to make its life a delight, in just the way to promote its extraordinary powers of multiplication, and so its enormous progres-



Boll Weevil in Cotton Boll, Above, and Mule Outfit for Spraying Field

Larva, Above, and Weevil, Greatly Enlarged, Below

sive spread until now the whole vast cotton belt is occupied." Aircraft, flying low over cotton fields early in the morning and late in the afternoon, scattering death-dealing dust upon boll-weevil infested plants, suggest the concerted wholesale efforts to destroy this insect. Machines, drawn by one or two mules down rows of cotton and distributing veritable clouds of poison dust, are not uncommon sights in the south. Then, too, the small farmer may use a hand spray in distributing calcium arsenate in the form of dry powder over his fields. Early planting of the crop and early fall destruction of the cotton plants are among the other control measures recommended.

Dr. Frederick B. Power and V. K. Chestnut, of the bureau of chemistry, are studying the cotton plant and the results of their studies will be interpreted in terms of further control measures of the boll weevil. For instance, we may have a fatal bait, an insecticide that will not only lure the insects but make sure of their destruction. The chemical warfare service is diverting war-time poison gases to the uses of destroying boll weevils.

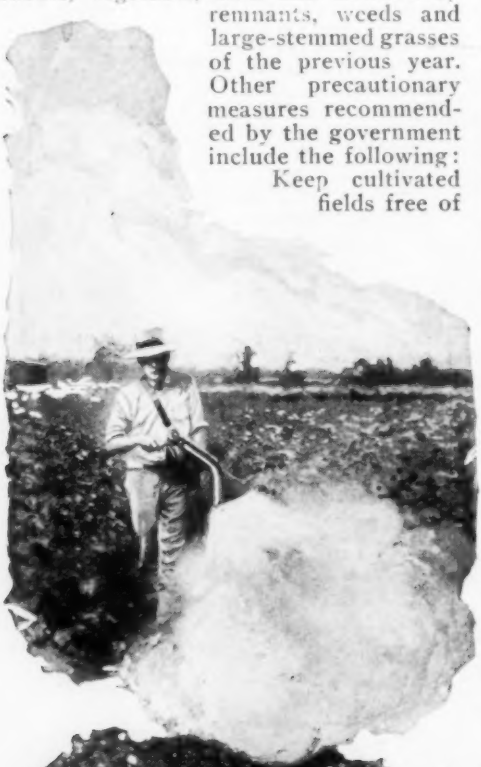
The menacing attitude of three other immigrants — the Japanese beetle, the

Spraying Fruit Trees to Kill Japanese Beetle; Two-Mule Sprayer for Cotton; Left, Corn-Borer Larvae

European corn borer, and the gipsy moth—is indicated when we are told that of the more than $2,500,000 appropriated for the bureau of entomology for the fiscal year of 1925, over $1,200,000 must be utilized in coping with these pests. This sum will be devoted to the establishment of quarantine zones for preventing the spread of these insects with the hope of gaining partial control. The areas infested by the European corn borer include large slices of territory in New England, New York, Ohio, Pennsylvania and Michigan. Scouting operations, however, have included field examinations in susceptible localities not only in the area east of and including the Mississippi river basin states, but also in Texas, New Mexico and Arizona.

A quarantine sign near Concord, Mass., reading, "Warning — European corn borer quarantine; do not carry green corn beyond this point; Federal and State laws provide heavy penalty for violations," is suggestive of one of the methods used in preventing the spread of this foreign foe. The primary control is the practice of burning or otherwise destroying, be-

fore May 1, all cornstalks, corncobs, corn stubble, vegetable, field and flower-crop remnants, weeds and large-stemmed grasses of the previous year. Other precautionary measures recommended by the government include the following: Keep cultivated fields free of weeds, cut corn close to the ground, cut and remove sweet-corn fodder from the field as soon as the ears are harvested.

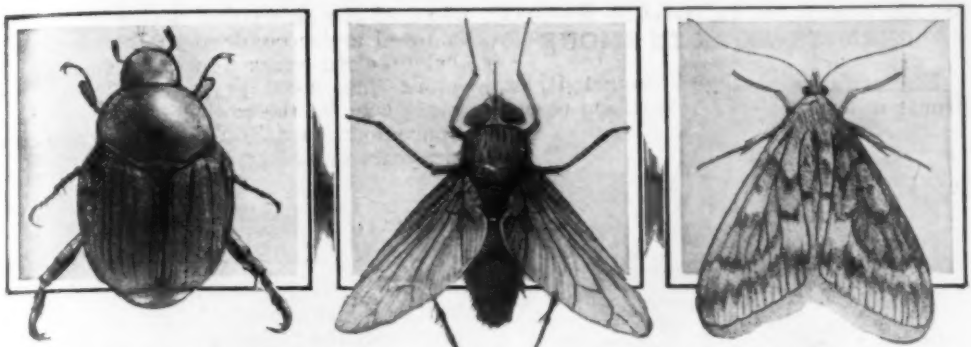


The Japanese beetle has infested an area of approximately 2,400 square miles. While this pest is limited to Pennsylvania, New Jersey and Delaware, its operations may be said to be intensive. The appetite of this insect is not discriminating. The bureau of entomology has indicted the Japanese beetle for preying upon no less than forty-odd economic plants.

Control measures recognize the enforcement of quarantine areas, thus restricting movements of products liable to contain the beetle. The common method of attacking it where it has already intrenched itself, is to spray poison on the infested material, the spray consisting of three pounds of powdered arsenate of lead, mixed with two pounds of flour and fifty gallons of water. A thorough job of spraying is recommended. Lately, natural enemies or useful parasites have been introduced from Japan to make warfare on this insidious foe.

The ever-growing army of insects is encouraged and propagated by our modern ways of travel. Or, to quote Doctor Howard, "So what is termed 'advancing civilization' is not only encouraging in-

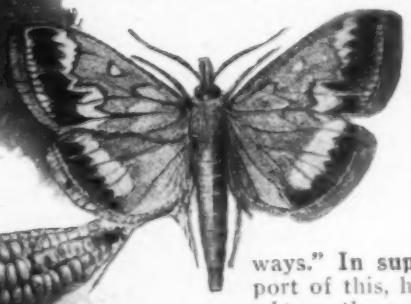
Hand Spraying of Cotton Field; Below, Sign Warning of the European Corn Borer

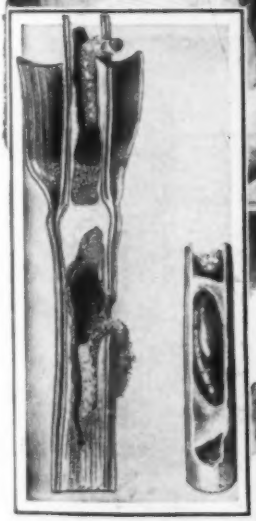


Above, at Left, Is the Destructive Japanese Beetle, and Next to It a Parasite Which Lays Its Eggs on the Body of the Beetle; the Eggs Develop into Larvae Which Feed on Their Host and Thus Kill the Beetle; Top, Right, Is a European Corn Borer

Below, Sign Posted to Prevent Spread of the Japanese-Beetle Plague

Below, Is a Moth Developed from European Corn Borer, One of the Imported Crop Pests





Left, Corn-Borer Larvae in Stalk, and Feeding on Immature Ears of Field Corn, Below

sects to multiply almost beyond bounds, but it is facilitating and hastening their spread in many ways." In support of this, he cites the example of T. Chalmers Mitchell and his companions, who, in flying from Cairo, Egypt, to the Cape of Good Hope, a few years ago, demonstrated that the airplane might spread insects.

## FIRE MASK WITH GLASS FRONT PERMITS WORK IN SMOKE

Firemen's helmets with protected glass fronts in use in Germany are said to permit the wearer to work with ease in smoke that would quickly suffocate an unprotected person. The chemical apparatus is carried in a convenient holder on the back, tubes connecting it to the mouthpiece, running under the left arm. The wide glass window allows free vision.

Side View of Helmet Which Has Wide Glass Front and Gas-Storage Tanks Behind

## TOWN TO BE TURNED INTO LAKE TO SUPPLY NEW YORK

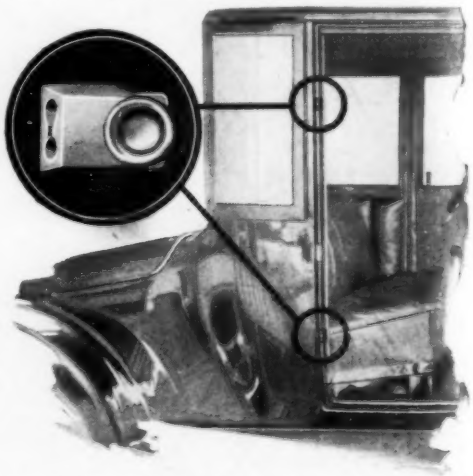
Once a prosperous farming center, the village of Gilboa, N. Y., founded in 1760, is being converted into a huge artificial lake, 150 feet deep, five miles long and holding 22,000,000,000 gallons of water to supply New York city. A big dam, overtopping the town's church steeple before the structure was razed, has been constructed to stop the creek that flowed through Gilboa. The water is to be carried through eighteen miles of tunnels cut through the Catskill mountains, to feed the Ashokan reservoir. The bore makes a drop of 500 feet and, in places, is large enough to accommodate an electric railway. Most of the 200 residents of the village scattered before completion of the dam, but a few lingered until the expiration of the thirty-day notice they were allowed under condemnation proceedings begun eight years ago. A cemetery of more than 1,000 graves was moved to make way for the project, which will cost approximately $22,000,000 and has taken six years to build.

## PORPOISE, KILLED FOR ITS OIL, SEEN AS LEATHER SOURCE

Approximately 60,000 square feet of leather is lost annually by not utilizing the carcass of the porpoise after the oil is extracted, according to an English expert. The animals are said to have a skin from which ten to twenty square feet of leather can be produced. It consists of an upper layer and underlying "splits," the first of which is thick and strong enough for the manufacture of heavy boots, and the second, being like suede leather, is particularly adapted to use in fancy goods, gloves and women's and children's shoes, as well as for covering furniture.

## DOOR SILENCER PROTECTS CLOSED-CAR WINDOWS

Rubber bumpers for the doors of closed cars are now on the market, to prevent rattling and the likelihood of breaking the windows when slamming the doors shut. They are quickly installed and replace the plain attachments with which the car already is provided. Their distinguishing feature is a little cushion that absorbs the impact of the door and forms a vacuum to grip it tightly, when closed.



Bumper Showing One Air Cushion, and Car Marked to Indicate Positions in Use

## BATHING BEACH SCENE OF NIGHTLY TREASURE HUNT

© Keystone
Searching the Beach for the Sparkle of Metal; Sifting Sand, and a Recovered Treasure

Groups of men with shovels, flashlights and sifters appear at Coney island when the bathers have departed at night, and make careful search through the sands for bracelets, rings, necklaces and other trinkets that may have been lost during the day. Their hunts are frequently rewarded as they learn to distinguish the glint of metal in the sand. They make their search soon after the beach is clear, so that articles will not be carried out by the waves.

### WATER HARDER THAN STEEL

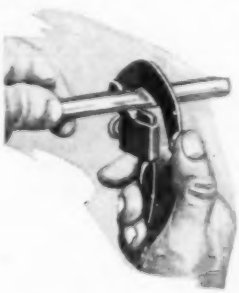
At a turbine station in Switzerland several jets of the issuing water are so rigid that a strong man armed with an iron crowbar would be unable to drive it through them, according to reports. The streams rush out of nozzles only one and one-half inches in diameter at a pressure of nearly two tons to the square inch.

### GIANT SEARCHLIGHT IS VISIBLE OVER TWO HUNDRED MILES

Intended originally as a beacon for war pilots, a powerful searchlight has just been installed on Mont Afrique, near Dijon, France, at a height of about 1,500 feet. In peace times it will act as a guide post for night-mail and passenger planes. Its billion-candlepower beam is visible to high-flying craft for some 250 miles in clear weather, and under favorable conditions may be seen in parts of Belgium, Germany, Switzerland and Italy, as well as practically all over France.

### HAND CUTTER FOR GLASS TUBES SAVES TIME AND WASTE

Glass tubes of different sizes are easily cut in any desired lengths with a hand tool that requires but little skill to operate and is not likely to break the work. The tube is held at right angles to the cutter and clasped within a small lever which is pressed down with the thumb. The glass is revolved toward the operator, and as it turns, the blade cuts into the tube around its entire circumference. A few light taps then will break the piece off squarely. The instrument may be attached to an ordinary glass cutter.



## FIFTEEN-POUND PORTABLE SAW IS ELECTRICALLY DRIVEN

Weighing only fifteen pounds, a new electrical saw will cut thousands of feet of lumber daily, it is claimed. The tool is so

Lightweight Electric Circular Saw Cuts Variety of Materials and Is Operated with One Hand

light that it can be operated with only one hand. It has a grip handle, with a make-and-break trigger switch. It is portable, and, deriving its power from any lighting socket, may be used in shop, millyard or home, as required. To operate it, the base is simply set on the desired line. A slight pressure on the handle moves the machine forward and the teeth steadily pull their way through the lumber. This portable saw is said to be equally effective in tearing through wood, bone, wallboard, fiber, linoleum, hard rubber and light-gauge soft metal.

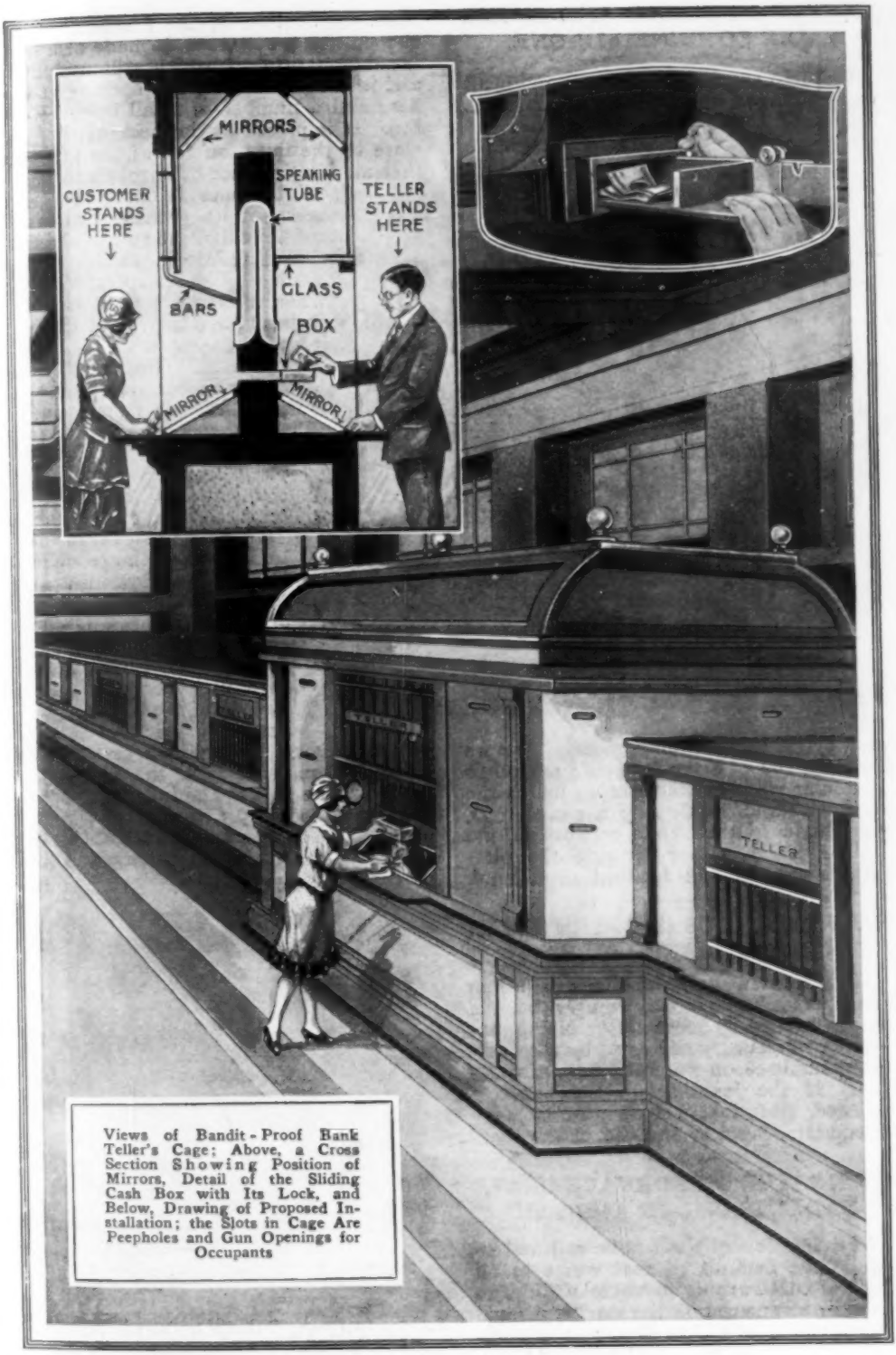
## HIGHER SPEED ON GOOD ROADS URGED FOR AUTO SAFETY

Present laws regarding motor vehicles are "as out of date as the hand crank," according to the American Automobile association in advocating increased speed on good highways that congestion may be relieved and greater safety insured. Officials of the association point out that the speed laws have not kept pace with the rapidly increasing number of cars and that there is no line drawn between speeds appropriate for different traffic, weather, car and road conditions. According to Richard Haldeman, chairman of the good roads board of the association, "the motoring public is driving too fast over the dangerous streets and is being held back for fear of technical violation in streets where there is no reason to run slowly." Dirt roads and concrete should not be blanketed with the same speed regulations, the association holds.

¶More emeralds are mined in Columbia than in any other country in the world.

## ARMORED BANK TELLERS' CAGES TO FOIL BANDITS

To protect the lives of bank employes and to guard the money, armored tellers' cages have been designed to foil attacks with the aid of bullets or gas. They are like small forts or "pill boxes," lined with heavy steel and are constructed so that they may be placed in front of the vault. Customers transact business at what appears to be an ordinary window. But they cannot see the man behind the rail, only his reflection in a mirror, and the clerk looks at the customer's image projected to his side of the cage over a steel wall. Conversation is carried on through a speaking tube. It is elbow-shaped to prevent entrance of gas to the cage and may be further shielded by a cloth filter. Additional safeguard against gas is afforded by a sheet of glass just above the teller's head. All moneys or papers that change hands are placed in a small steel drawer so arranged that it can be locked instantly by the clerk from his side of the window. It slides out on ball bearings in position for the customer to reach it, and steel cleats prevent its being pulled out from the cage. The mirrors are placed so that the customer can see whatever is put into the drawer and safeguard himself against errors. Steel bars are placed across the reflecting space on the outer side of the cage so no one can climb into the teller's compartment. The mirrors afford a clear view from both sides and the speaking tube decreases the volume of the voice very little. A simple and effective means is provided for ventilating the interior of the cage, which is securely roofed with steel. There are peepholes through which the teller may command a view of the main room, and openings for a weapon in case occasion demands his help in resisting an attack. The cage has been on exhibition in a mid-western city and has gained the endorsement of a bankers' association.




Views of Bandit-Proof Bank Teller's Cage; Above, a Cross Section Showing Position of Mirrors, Detail of the Sliding Cash Box with Its Lock, and Below, Drawing of Proposed Installation; the Slots in Cage Are Peepholes and Gun Openings for Occupants

## MERRY-GO-ROUND AND SWING ARE COMBINED IN ONE

Children are finding pleasure and health in a combined merry-go-round and swing

Platform Suspended from Top of Pole Is Pushed Back and Forth as Swing or Rotated as a Merry-Go-Round

now being used in playgrounds. Ropes from the top of a ten-foot pole extend to a circular wooden platform on which the children stand, holding to a guard rope, waist-high. Other children furnish the motive power, either pushing the platform backward and forward or around.

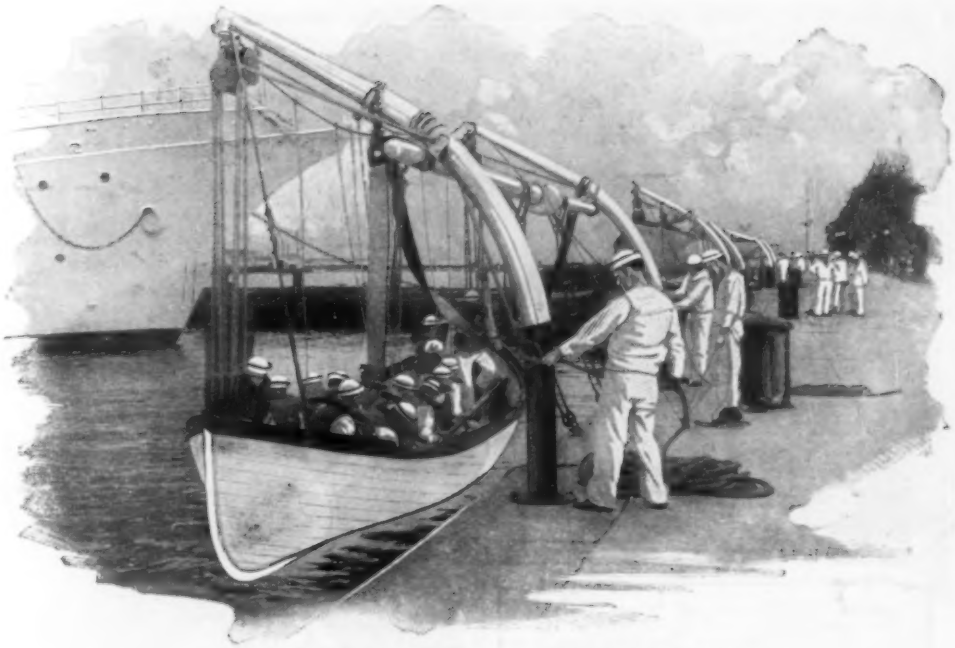
## HAUNTED HOUSES OFTEN MEAN LOOSE WATER PIPES

Mysterious noises, sometimes heard in unoccupied houses, may simply be the sounds caused by loose water piping, according to a theory advanced by the Indiana committee on public-utility information. If the lengths are not securely fastened, vibrations, set up near by, may be communicated to the vacant dwelling.

## AIR HEATER ON FURNACE GRATE REDUCES SMOKE AND ASH

As a solution of the smoke evil and to reduce the amount of fuel waste in all kinds of coal-burning furnaces, a Chicago inventor has placed on the market a small preheater that is said to effect almost complete combustion in the fire box. It is shaped like a coffeepot, is made of a carborundum product which will not melt, and is hollow, with a wide opening at the base and a number of small holes at the top. It is placed at the back of the fire, close to the flues, on top of the grate so that air has free access through it. The "pot" becomes intensely hot and because of its peculiar properties transmits this heat to the air current passing into it, which is raised to such a high temperature that when it is released, about four inches above the top of the fire, it ignites the gases that have not been burned. This prevents the formation of soot and gains almost full benefit from the coal. The heater is from ten to nineteen inches high, weighs from twelve to 125 pounds and is installed without any alterations on the furnace. Two or more can be used, if desired, in large boilers. Tests have shown that the device will reduce the amount of ashes and clinkers over forty per cent and the coal consumption more than fifty per cent. It is also claimed that poor grades of fuel can be burned with almost as good results as the more expensive qualities with the aid of the heater. One reason for incomplete combustion in ordinary furnaces is that most of the oxygen is used up before the air has passed through the coals, according to government experiments.

Drawing Illustrating Preheater in Operation, Air Passing under Grate, through Pot and Igniting Gases



# FOUR YEARS AT ANNAPOLIS

## III—The Third Year

WITH June week gone, the midshipman entering his third year passes into the second class, and immediately leaves on the summer cruise, which is followed by the annual September vacation. To the eighth of an inch band of gold braid on his left sleeve, he adds a second one, a quarter of an inch away. His increased rank carries with it harder work during the cruise at navigation and in executive positions.

The midshipmen have a chance to try all departments in warship operation on their training trips, from shoveling coal in the stokehold to guiding the big vessel, under the eye of a naval officer instructor. Engine-room force and deck crew alike are drawn from the middies' ranks, and since the newer oil-burning battleships are not assigned for the practice squadron, the entire regiment draws the unpleasant task of coaling ship, followed by a session of scrubbing down and repainting.

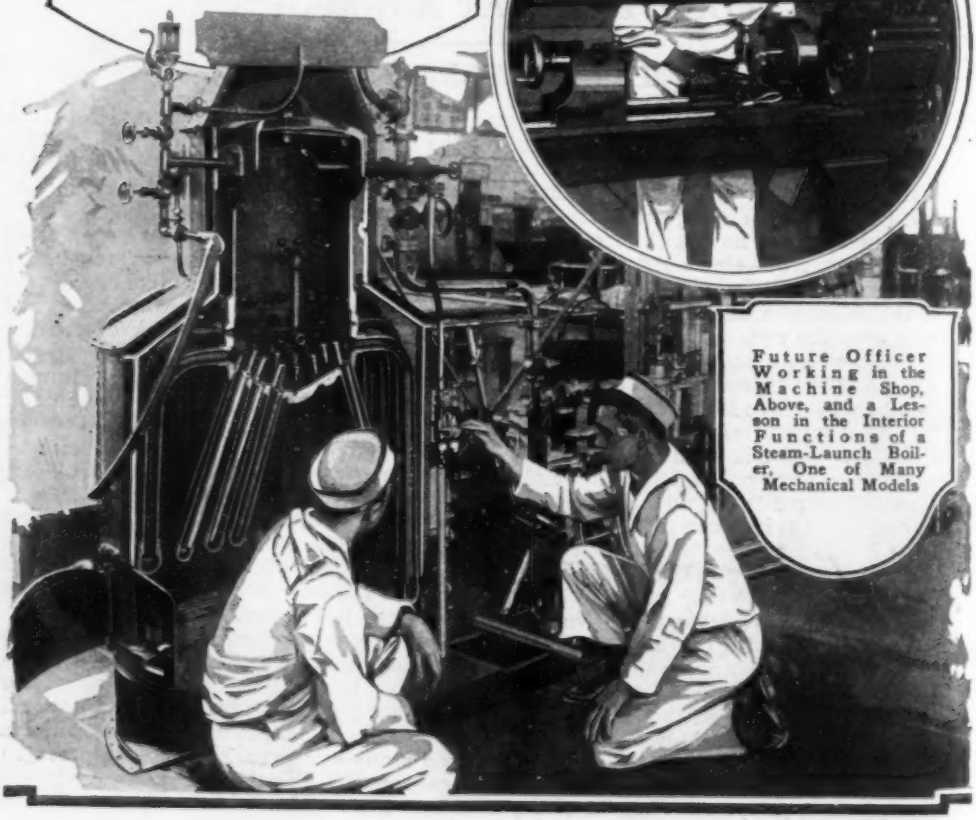
Back at the academy in October, the regular grind of lessons and drills is resumed, the technical lessons being a bit more severe than during the second year. The daily work, however, is brightened with a few more privileges in recreation hours, and plenty of athletics. Sport is as much a study as any other subject; every boy is graded and must average 2.5 to pass. He must be able to swim, must go through the regular gymnasium drills creditably, and must participate in one or more of the outdoor games.

Social life also is not neglected, regular "hops" being held in the armory. Discipline at these is as strictly regulated as in the daily routine. The second-class middy is permitted to leave the grounds an hour before the ball starts, to call for the lady. Without special permission he may not take her home before the hop is over, and he must be back in his quarters within forty-five minutes after the last dance.

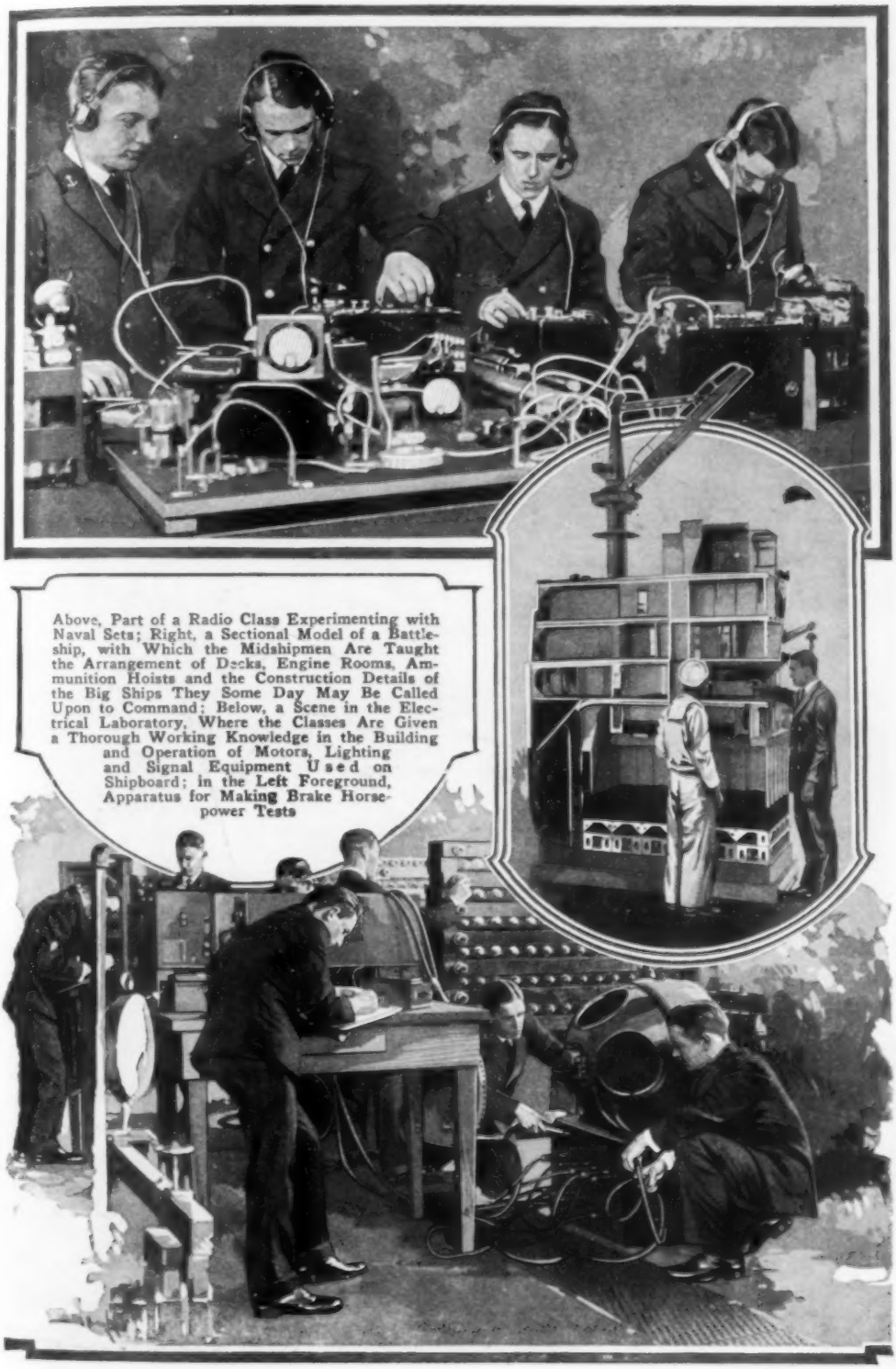
The middy and his girl walk to and from the hops, since members of the regiment are forbidden to ride in any vehicle except during their September leave. The second-class man, with his increased allowance of $8 a month, is able to spend a bit more than in the previous years, but the difference of $3 does not go far. A little booklet entitled "Dope for Drags"—a middy's girl is always a "drag" since academy rules forbid his taking her arm but permit her to take his—finds a ready sale among the midshipmen to send to friends who contemplate visiting the academy.

Next month the story of the last year of life at the naval academy will be told.

Above, Midshipmen at Work in the Blacksmith Shop, and Right, Part of the Midshipmen's Regiment Standing Inspection on the Terrace of Bancroft Hall

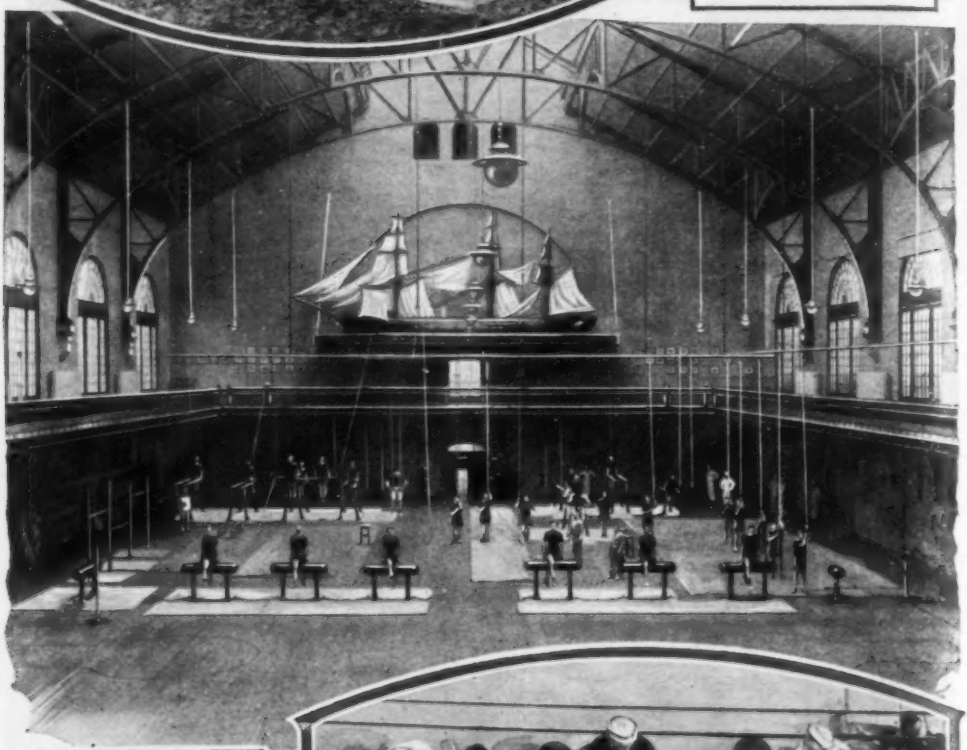


Future Officer Working in the Machine Shop, Above, and a Lesson in the Interior Functions of a Steam-Launch Boiler, One of Many Mechanical Models

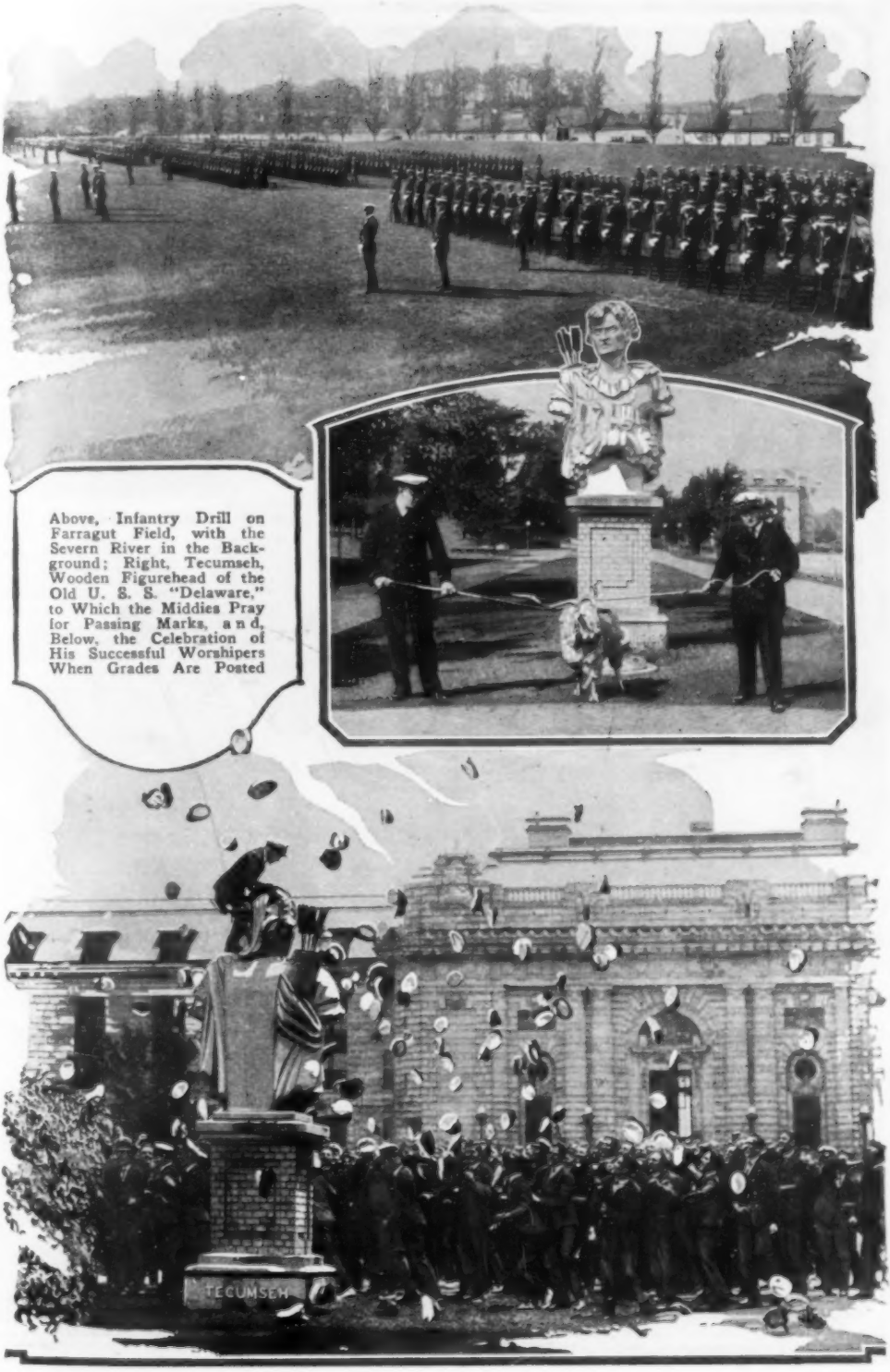


Above, Part of a Radio Class Experimenting with Naval Sets; Right, a Sectional Model of a Battleship, with Which the Midshipmen Are Taught the Arrangement of Decks, Engine Rooms, Ammunition Hoists and the Construction Details of the Big Ships They Some Day May Be Called Upon to Command; Below, a Scene in the Electrical Laboratory, Where the Classes Are Given a Thorough Working Knowledge in the Building and Operation of Motors, Lighting and Signal Equipment Used on Shipboard; in the Left Foreground, Apparatus for Making Brake Horsepower Tests

Infantry Drills for Use of Landing Parties from the Fleet Are Taught the Regiment of Middies; at Left Is a Scene on the Rifle Range; Below, a Squad Ready to Start the Afternoon Workout in the Gymnasium, Where Physical Tests Must Be Passed with the Same High Grades as Demanded in Classrooms

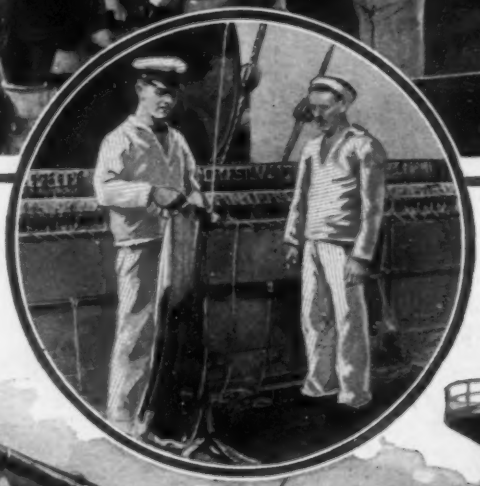


There Is Plenty of Hard Work to Be Done during the Summer Cruise, but When the Day's Labor Is Done Comes "Happy Hour," Given Over to Music and Games; Here Is an Impromptu Orchestra of Middies Gathered around the Ship's Piano, Hauled Out on Deck for the Occasion; Music, like Sports, Is Encouraged as One of the Best Ways of Keeping Up Morale

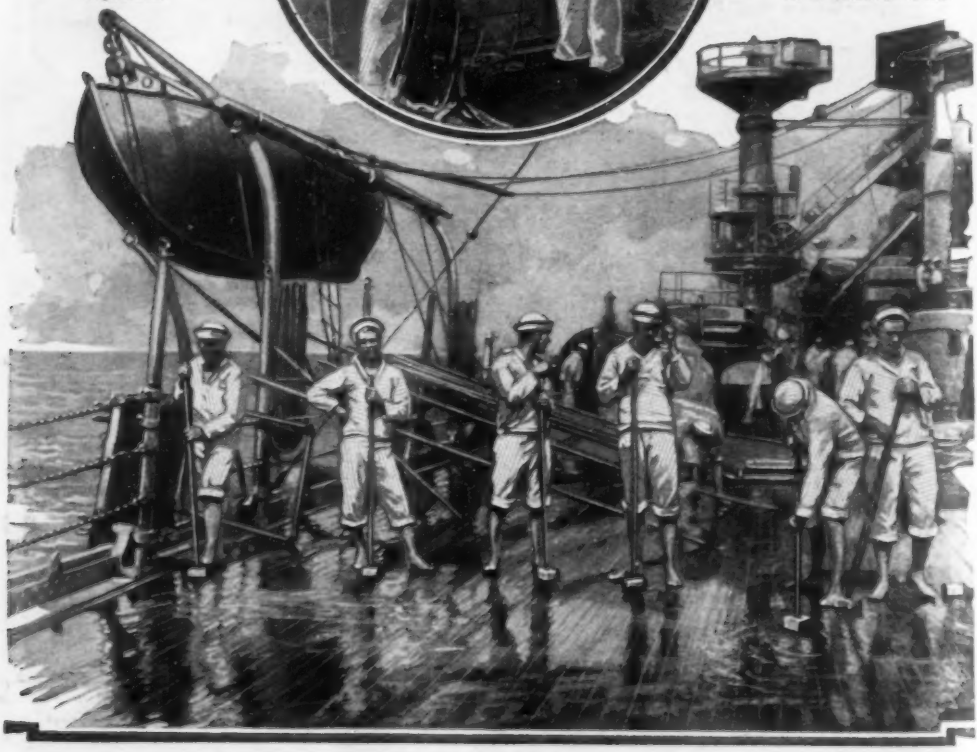



Above, Infantry Drill on Farragut Field, with the Severn River in the Background; Right, Tecumseh, Wooden Figurehead of the Old U. S. S. "Delaware," to Which the Middies Pray for Passing Marks, and, Below, the Celebration of His Successful Worshipers When Grades Are Posted

Middies at the Wheel of a Battleship on Summer Cruise, and, Center, Handling the Signal-Flag Locker and Preparing to Hoist Code Flags to Guide the Squadron



Future Admirals at Their Morning Job of Holystoning the Deck of a Battleship during the Summer Cruise, When They Get a First-Hand Knowledge of a Sailor's Work



Above, Mess Table Set in a Gun Turret on Summer Cruise and, Right, Sea Bags Being Carted Down to the Dock on the Severn to Be Ferried Out to the Squadron Lying in the Bay

Above, Repairing a Target after Big-Gun Practice at Sea; Two Direct Hits Have Been Made in the Canvas Sheet, Towed Miles Away behind Another Ship; at Right, a Scene in the Fire Room; the Middies Get the Older Coal-Burning Battleships for Their Summer Training Instead of the More Modern Oil Burners and Learn How Hot a Fire Room Can Get

In a Spirit of Democracy Use of All Kinds of Vehicles Is Forbidden to the Middies, But Here Is One Who Could Not Resist the Lure of the Queer Carriages That Ply between Gibraltar and the Spanish Towns behind the Big Rock, One of the Interesting Scenes Visited on a Summer Training Cruise

Left, Red-Cross Squad with Stretcher Following the Landing Party during a Sham Battle Fought on Farragut Field, at the Mouth of the Severn; Below, Chapel Service on Deck; Religious Services Are Mandatory at Annapolis, but the Middy Has His Choice between Chapel or One of the Churches in the Town; at Sea the Ship Chaplain Officiates for All

## TRACE THE HISTORY OF STEEL BACK THROUGH AGES

Chippings from an old iron pillar that has stood in Delhi, India, since 300 B.C., a metal cramp from the tomb of Cyrus, founder of the Persian empire, specimens of steel and iron from ancient Ceylon, and nuts and bolts from a Viking ship of the eighth century have been collected by Sir Robert Hadfield, the famous steel expert, while tracing the beginning of the steel industry, and were exhibited recently before the British mining and metallurgical congress. In comparison with these early specimens, samples illustrating the latest developments in electrical melting and in X-ray processes were displayed. The beginnings of the iron age have been traced as far back as 4,000 B.C. The era of steel received great impetus in 1856, when Bessemer invented his process for making a high-grade steel.

## TRIPLE CROSSING HELPS SOLVE TRAFFIC PROBLEM

Engineers solved a vexing traffic problem near San Diego, Calif., eliminated a death trap and made faster schedules for a railroad and traction line possible by constructing a three-tiered crossing. A subway was built under the steam tracks for vehicles. Its floor lay two feet below the sea level and automatic pumps had to be installed to eliminate seepage and storm waters. The railway line was left at its original level and the electric trains run on a viaduct, 1,000 feet long and well above the ground. Before this arrangement, a number of fatal accidents had occurred and trains lost time as they were required to come almost to a halt at this point.

## GIRLS PROTECTED BY ARMOR FROM BURSTING BOTTLES

Wire masks, somewhat similar to those used by baseball catchers, are being furnished in an English factory to girls who fill bottles with soda pop. The precaution was made necessary to protect the girls against flying glass, as the bottles break frequently under the high pressure of the carbonated waters. Heavy felt sleeves and a thick leather apron complete the costume.

Soda Bottles Frequently Burst While Being Filled; Girl Workers Are Being Armored to Protect Them from Flying Glass

## SUITCASE IN THREE SECTIONS HAS SPACE FOR HATS

Separate compartments are provided for hats, shoes, suits and other articles in a three-section suitcase especially convenient for the sportsman but serviceable to any traveler. Two smaller spaces open out at the ends and fold together to form the upper part of the case. A strap about the center, holds the sections from falling apart. Articles can be packed or unpacked without disturbing the contents of the entire holder.

Folding Suitcase Open, to Show Separate Compartments for Hats, Clothing and Other Articles

## CAR SEAT MADE INTO TABLE BY AID OF FRAME SUPPORT

Using the automobile cushion as a picnic table is made an easy matter with the aid of a frame support whose legs fold flat

Collapsible Frame Used to Support Auto Seat and Convert It into Table for Picnics

for stowing beneath the seat when not in use. To make a table, the legs are unfolded, the cushion placed on the flat top, and a cloth or newspapers draped over all. Two of the supports, with as many seats, will make a narrow but comfortable bed for campers.

## DURABLE DOLLAR BILL SOUGHT TO REDUCE PRINTING COST

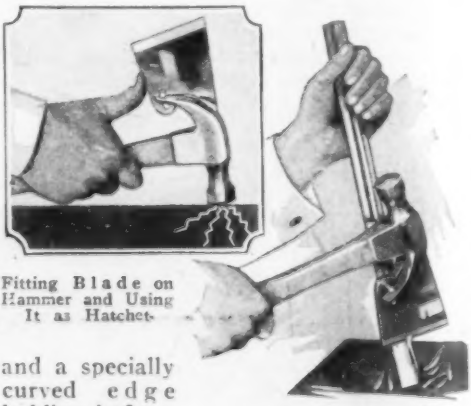
Five one-dollar bills were made for every one of the 114,000,000 or so persons in the United States last year at a printing and paper-manufacturing cost of nearly $4,000,000. Because of its great popularity, the dollar bill now constitutes fifty per cent of all the paper money and it wears out so quickly that presses in the government plants are continually turning out new ones to replace those that become unfit for service. About 800 tons of them were printed last year. Investigations are under way to determine if a better quality of paper may be obtained to prolong the life of the bills. For many years, linen and cotton have been used in the ratio of seventy-five per cent of the former to twenty-five of the latter. The government is wondering if this is the best proportion to use, and samples of paper with varying amounts of the materials are being tested by rubbing, pulling and subjecting them to water and oils to determine their resistance. The effect of beating the fibers and bleaching them during the process of manufacture is also being studied as is the sizing operation, which consists in giving the paper a bath in animal glues to strengthen it. Hemp, esparto, a grass from Spain, and ramie grass from China, are also being tested as substitutes for linen and cotton fiber.

## MOVIES DETECT DEAD "VOTERS" IN ELECTION FRAUDS

Eighteen thousand dead men "voters" have been uncovered in a municipal election at Marseilles, France, through the use of a motion-picture machine. An anti-trust organization, finding itself defeated by a narrow margin, noted that the total vote had increased from 80,000 to 100,000 in a few years. Because France allows only five days for exposure of fraud and a recount of ballots, the leaders hit upon the idea of taking a moving picture of the long list of voters. Then the films were projected for copy in front of 300 letter writers. An inquiry was sent to each of the 100,000 names on the list. Shortly 18,000 letters came back marked "unknown" or "dead," and the fraud was exposed.

## HAMMER CHANGED TO HATCHET BY REMOVABLE BLADE

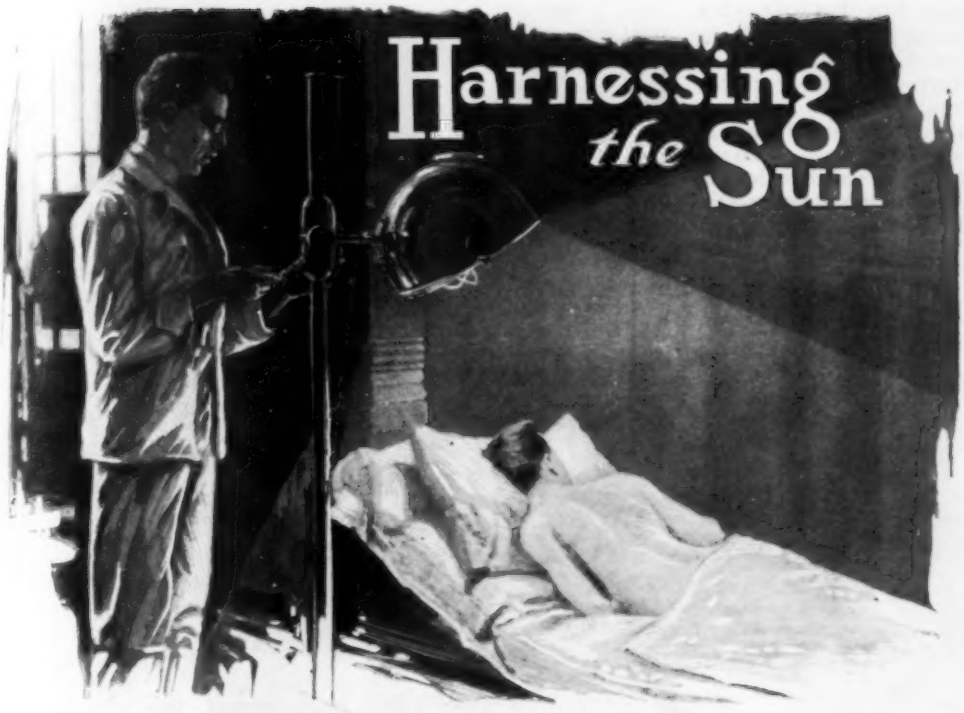
Quickly attached to the hammer by inserting it between the claws, a blade fits the implement for use as a hatchet, saving the need of an extra tool. There are no screws or bolts, prongs on the blade



Fitting Blade on Hammer and Using It as Hatchet

and a specially curved edge holding it firmly to the hammer. Detached, the cutter may be used as a chisel, and can be carried in the pocket or belt.

# Harnessing the Sun



FROM the ancient days when the sun was worshiped as the source of all life, science has progressed until today its rays have been harnessed to cure disease, increase crops, make chickens lay, season lumber, produce synthetic foods and test the permanency of paint, leather and other materials.

Only thirteen per cent of the entire radiation from the sun, it has been found, is visible to the eye in the light waves we see. Passed through a prism, or broken up by drops of water, as in a rainbow, the light rays separate into the seven primary colors of the spectrum—red, orange, yellow, green, blue, indigo and violet. Below this visible spectrum eighty per cent of the sun's rays are grouped in the infrared band, which produces heat, and above the visible rays are the remaining seven per cent, the ultraviolet, chemical, or actinic band, which produces, among other things, sunburn.

The enormous heat generated in electrical furnaces, far surpassing any temperatures heretofore created by man, has made possible the production on a commercial scale of fused quartz, the only material so far found which will transmit the latter group of rays, and with that discovery it is now possible to inclose any strong artificial light in a quartz globe and proceed to utilize this invisible part of the light, exactly duplicating the curative rays of the sun.

Fused quartz is a peculiar material which has the remarkable quality of transmitting the light through itself and around bends and corners and finally delivering the rays at the other end. Light applied at one end of a long, curved or bent rod of quartz will come out the other end, so that the curative rays can be delivered at any spot needed. One of the applications of this peculiarity is in curing hay fever by applying the rays directly within the nose, where the plant pollen has produced the infection. A slender rod of quartz, receiving light at one end, is inserted directly into the nasal orifice and the healing rays, fatal to bacteria, are delivered where they are needed.

Because of the great strength of the rays, fifteen minutes' exposure to a strong mercury light inclosed in a quartz bulb will produce a bad case of sunburn, but with gradual and repeated exposure a rich coat of tan may be obtained. The rays are so strong that protective goggles must be worn to guard the eyes, which otherwise would suffer as much as though looking directly into the flaming ball of the sun.

American experimenters a few months

ago found that the ultraviolet rays from quartz lamps would cure children or chickens of rickets, a disease of deformed and undeveloped bones due to the absence of calcium. In London a free clinic has been opened in the slums for the treatment of poor children who,

Courtesy London Illustrated News

**With Goggles to Protect the Eyes These Groups of Babies Are Receiving the Ultraviolet Treatment Which Will Restore Them to Health**

because of tenement life and poor surroundings, have failed to get the proper amount of natural sunlight to develop their bone structure.

Tests have shown that the invisible rays, whether natural or produced from artificial light, will cause the deposit of phosphorus, calcium and iron, three of the chief bone-building materials in the body.

In Guy's hospital and the Infants' hospital in London, immense 30,000-candle-power mercury lights inclosed in quartz are used in the sun-ray treatment rooms. Doctors and nurses, with their skin deeply bronzed from continual exposure, wear hoods and masks to protect them from the burning light, while the patients, with goggles strapped to their foreheads and dressed only in trunks or a towel, bask under the glare. A half hour's treatment is the most they can stand during the first few days, but gradually the period of treatment is lengthened to four hours a day, after a protective coat of tan has been acquired. Bad skin complaints vanish magically, and dull, stunted boys and girls put on weight, straighten up and become quick and intelligent in their movements.

The ultraviolet rays which produce these remarkable changes are unbelievably small. Their wavelength is measured in terms of a unit which is, roughly, the ten-millionth part of the thickness of a human hair. The red heat rays cease to be visible when they have reached a shortness of 7,500 of these minute units, and the violet ray at the top of the spectrum passes into invisibility at 3,900 units. With delicate scientific apparatus, however, explorers of this unknown band have pur-

sued the shorter rays down to a region where their length is but 420 ten-millionths of the diameter of a hair. Beyond this point is the region where the mysterious change from light to X-rays takes place.

Their discovery revealed the reason why sun bathers in the high Alps of Italy could walk barefoot in the snow while they were cured and tanned by the sun. In warmer and lower climes, the excess of infra-red heat rays cuts off the free play of the curative part of light, while high up in the mountains the germs of such diseases as tuberculosis yield to the killing action of the invisible waves. The clear air of the heights, free from smoke and beyond most of the dust clouds which hover above the earth, offers a free road for the natural ultraviolet rays of the sun, the most powerful of which are so small they cannot penetrate a distance equal to the thickness of an invisible microbe.

In producing artificial sunlight, however, the scientists found that a small 22-volt mercury-vapor light in a quartz tube, suitable for suspending over a child's cot, was so powerful that its rays could sterilize 132,000 gallons of water in twenty-four hours, killing all the disease germs it contained.

Dr. Leonard Hull, one of the English experimenters, is establishing these artificial sunlights in many of the public baths of London, so that the children of the

Giving Light Treatment for Rickets to Children in London Hospital

Courtesy Infants' Hospital, Westminster, London

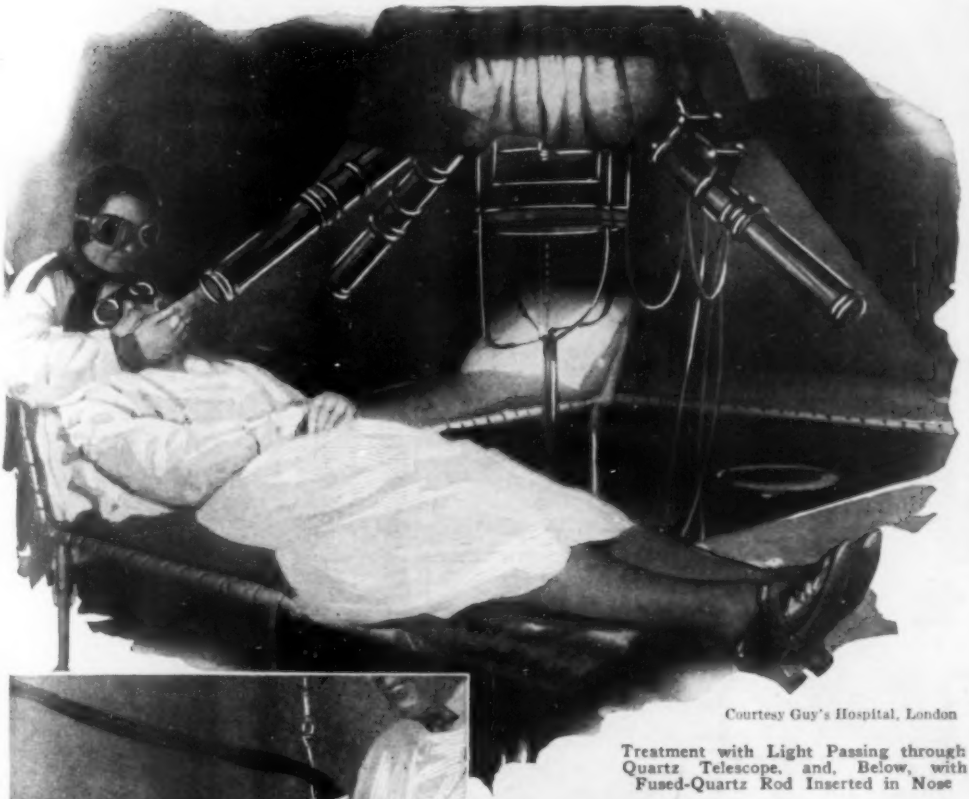
poor can take a light bath along with one in water. Another Englishman, F. E. Lamplough, is perfecting a new form of glass which will pass most of the ultraviolet rays and which can be produced at a cost of seventy-five cents to one dollar a square foot, far cheaper than the expensive quartz. The latter costs so much, because of the vast amount of electricity used in fusing the material, that only one quartz window, in Johns Hopkins hospital, Baltimore, has so far been installed. If the new glass proves successful, nearly every one will be able to afford a sun-bath window in the home and can harness the natural sunlight to prevent disease.

Still another experimenter has developed an arc lamp, with tungsten electrodes, following his accidental discovery that this metal would produce far more ultraviolet rays and less of the heat waves than other materials. In an address before the Roentgen society in London recently, it was claimed that two or three minutes' exposure twice a week to this powerful artificial sun would cure functional complaints, nervous debility and the neurasthenia caused by the hurry and worry of modern life. With this strange light, the patient can lie, fully clothed, on an electrical couch, grasping a bar electrode in his hands, and thus become one plate of a powerful electrical condenser.

The United States bureau of standards, experimenting with the germicidal effect of ultraviolet rays, found that bacteria in sewage could be killed in half a second by exposure to them. At Yale, two professors trying to discover why cod-liver oil cures rickets, found that it actually emits ultraviolet rays in the child's body. They likewise found that cottonseed and linseed oil could be treated with the rays, and then used as a medicine to accomplish the same cure.

In stimulating plant growth, experiments have shown that wheat, grown in the dark, can be converted into a ripened food after two minutes' exposure. The

Group of Children Gathered around an Artificial Sunshine Lamp in a Free Clinic Established in London



Courtesy Guy's Hospital, London

**Treatment with Light Passing through Quartz Telescope, and, Below, with Fused-Quartz Rod Inserted in Nose**

rays also have been used to produce synthetic sugar by passing them through ordinary formaldehyde. Chemists have known for some time that sugar cane and other plants make sugar by a process in which solar rays, falling on the plant, are caused to extract carbon from the air, and this carbon, added by the plant to water absorbed by its roots, is converted by nature into formaldehyde from which sugar eventually can be extracted.

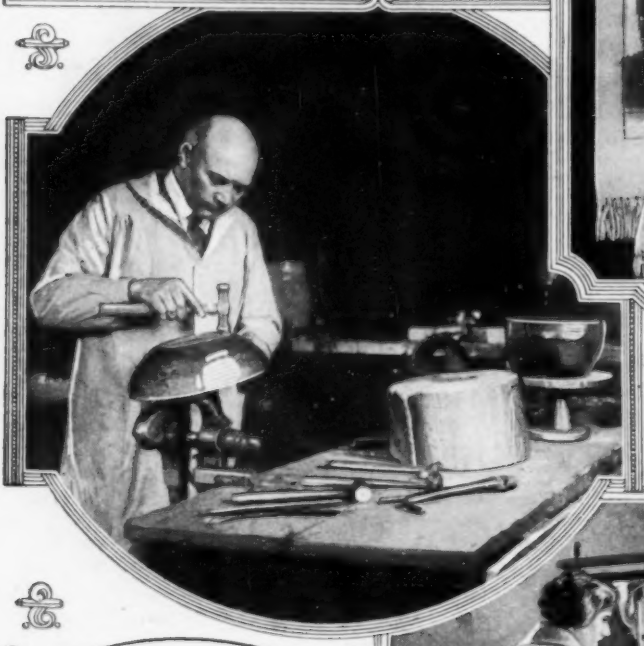
Because of the concentration of the rays possible with artificial sunlight, producing a deep tan in less time than the sun itself would take, paint manufacturers are utilizing the ultraviolet-ray lamps to age paints to the equivalent of several years' natural exposure within a few days, to test the lasting qualities of their product. Lumber also is being given months of seasoning within a few hours.

## SNOW-WHITE HORSES RARE

To obtain six snow-white horses, an Italian commission recently visited the leading farms in Hungary. The animals were wanted to draw the Pope's carriage in the Holy Year celebration. Many animals were inspected which at first sight appeared snow-white but showed spots on closer examination. The desired horses were found only after a long search.

# Art and Utility Combined in Handicraft

Mrs. Frank Smith with Samples of Her Work in Basketry, One of the Activities of the Handicraft Guild of Washington, and, Below, Mufflers and Spreads with Designs Woven into the Cloth



Metal Objects Are Carefully Modeled and Pounded Out in Olaf Langstad's Workshop Which the Guild Devotes to This Ancient and Artistic Form of Handiwork

At Her Loom in the Nation's Capital, Mrs. Emma Sommar Weaves Bedspreads, Scarfs and Many Other Articles Like Those Produced by the Mountain Women of Kentucky, Tennessee and North Carolina, an Art That Has Been Inherited from the Early Colonial Days

## PRISONERS SHARE IN PROFITS OF FLAX MILL

A prison-operated flax mill, which boasts it is the largest in the world, gives employment to 175 convicts in the Oregon state penitentiary, and the workers share in the profits of the industry, drawing fifty cents a day in pay from the state. The mill has twenty-four scutching machines, while its nearest competitor in point of size is a mill in Ireland with twenty-three machines. More than two thousand acres in the Willamette valley were planted to flax this year, the state furnishing the seed for the farmers and buying the crop when cut and delivered at the prison mill. The quality is said to compare favorably with the best Canadian, Irish or Belgian flax. The convicts employed in the industry are all so-called trusties and work under civilian overseers without any armed guards to watch them.

Record-Breaking Wooden-Stave Flume; Notice the Horse and Man Standing Inside and the Workman Perched on Top

## WRENCH IS SELF-ADJUSTING TO MANY SIZES OF NUTS

A new type of spanner wrench, which adjusts itself to a considerable range of hexagonal and square nuts, has been placed on the English market by a Liverpool company. The construction is simple. The handle, pinned to the head, ends in a camlike curve, which forces a serrated jaw up through a slotted channel in the head until it grips the nut. The harder the nut is to turn, the greater the grip of the wrench. All the wearing surfaces are casehardened.

## PIPE SIXTEEN FEET IN DIAMETER BUILT OF WOODEN STAVES

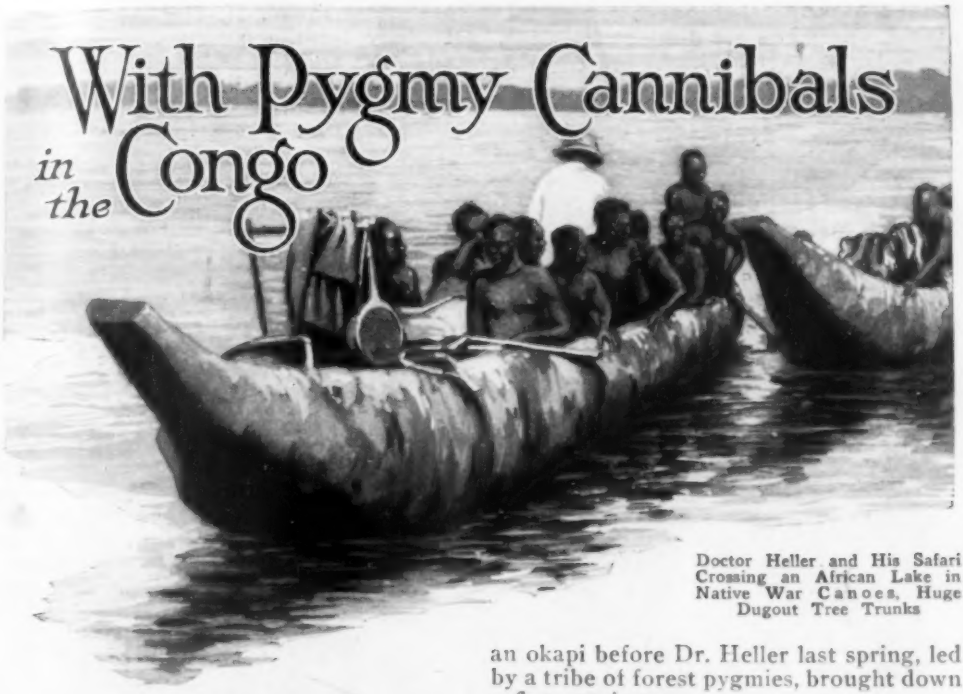
Winding a quarter of a mile through the mountains in northern California, a huge wooden pipe, sixteen feet in diameter, has been constructed to convey water to a power house. Steel hoops and braces bind the staves tightly together to prevent breaks under the high pressure.

## CURE FOR WOODPECKER HOLES IN POLES IS SOUGHT

Woodpeckers using telegraph and telephone poles for food-storage bins are causing serious damage in various sections, especially those in which oak trees abound. The birds find a barkless pole is easier to bore than a tough, live tree. Into each hole made with their bills the woodpeckers place an acorn against the season of hunger. When rain comes, the nut swells and cracks the wood. Hundreds of such holes may be found in a single pole. Coatings of creosote keep out insect borers, tin bands discourage squirrels, but nothing has been found yet that will stop the woodpecker.

Suspension-Bridge Building in the Heart of the Congo; a Native Workman Building a Roadway High above the Impenetrable Jungle, Following the Monkey Route through the Trees

# With Pygmy Cannibals in the Congo



Doctor Heller and His Safari Crossing an African Lake in Native War Canoes, Huge Dugout Tree Trunks

SOMEWHERE in the darkest part of darkest Africa, a few miles south of the equator and in the midst of the dense tropical jungle which forms the backdoor of the Belgian Congo, an American explorer and big-game hunter and his wife, with sixty Wambubu cannibals for servants, are now hunting gorillas.

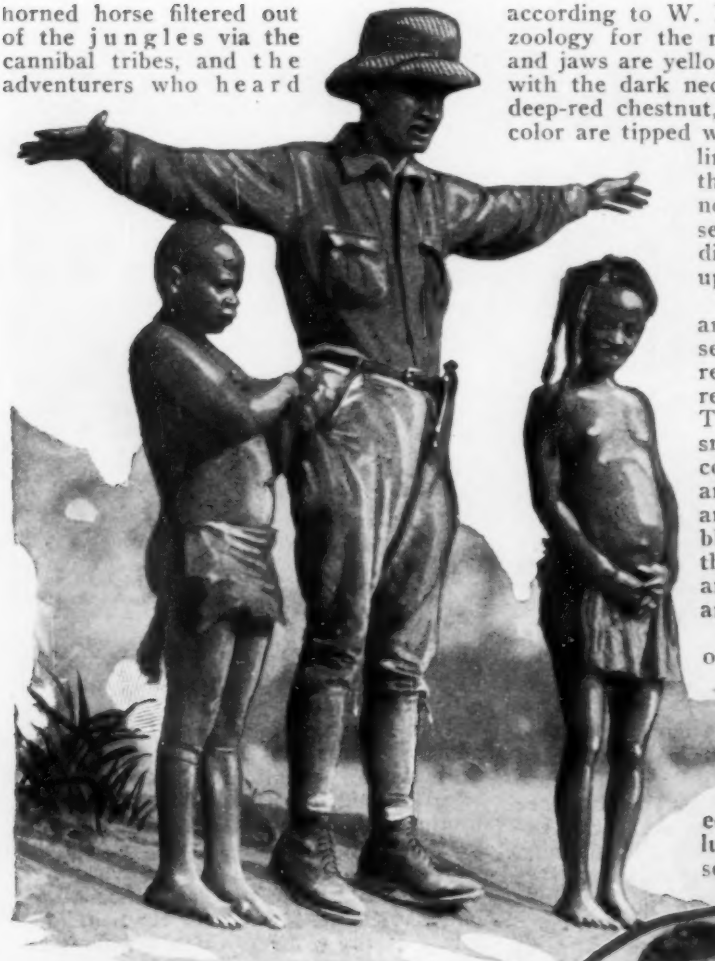
The hunter is Dr. Edmund Heller, who, as Roosevelt's right-hand man, and at other times with Carl Akeley, Paul Rainey, or alone, has walked over most of the little known miles of Africa. His wife, Hilda Heller, daughter of the late Professor Hempl, philologist of Leland Stanford university, and a big-game hunter in her own right, is filming his battles in the jungles and also assisting in collecting specimens for the Field museum, Chicago.

Their present gorilla hunt, following one Dr. Heller made last year, when a 350-pound monster with an arm spread of twelve feet was shot, winds up a two-year expedition in that one part of Africa which still remains wild and dark. During it they have collected thousands of specimens ranging from frogs and butterflies to enormous gorillas, baboons, chimpanzees, and, rarest of all, an okapi, an animal so seldom seen that its very existence was for a long time in doubt. Only one American expedition had ever bagged an okapi before Dr. Heller last spring, led by a tribe of forest pygmies, brought down a fine specimen.

This "trophy of trophies" has a body somewhat like that of a zebra, a three-horned head resembling that of a giraffe and the bulk of an ox. Famous hunters by the score have invaded its hiding place in the past and come back with lions, tigers, elephants, rhinos and other jungle denizens, but no okapi. The lair of the one known herd is the dense Semliki, a forest of the Congo, which was first explored twenty-five years ago by Sir Harry Johnston, the English explorer and writer. He described it as "almost unbreathable with its Turkish-bath heat, its reeking moisture and its powerful smell of decaying vegetation," where one "seemed, in fact, to be transplanted back to the Miocene times, to an age and a climate scarcely suitable for the modern type of humanity."

In the edges of the forest live a tribe of little, four-foot tall pygmies, whose only commerce with the outside is through the Wambubu cannibals, with whose old chief, Morea, they are on friendly terms. Through Morea, Dr. Heller arranged with the pygmies, armed with their primitive bows and arrows, to lead him to the lair of the okapi. There is more scientific romance and folklore woven about the strange beast than about any other living animal. Before it was first seen by a white man, vague tales of a cloven-hoofed,

horned horse filtered out of the jungles via the cannibal tribes, and the adventurers who heard them brought back stories that the unicorn of fable might actually exist there. One naturalist who sought a glimpse of the mysterious beast, but was defeated when he had to turn back because of fever, reported he believed it was a living survival of the Hipparion, or three-toed horse, which existed millions of years ago.



Heller, Who Is Five Feet Ten Inches Tall, with Two of the Full-Grown Forest Pygmies; Below, the Chief Musician to a Cannibal King

While the body of the okapi suggests that of a zebra, the long forelegs pitch the fore quarters upward, somewhat like the tilt of a giraffe. The neck is short, not much longer than a stag's and the giraffelike head, with three rudimentary horns, is crested with large ears. "The color of the animal is extraordinary," according to W. H. Osgood, curator of zoology for the museum. "The cheeks and jaws are yellowish white, contrasting with the dark neck. The forehead is a deep-red chestnut, and ears of the same color are tipped with jet-black. A black line follows the ridge of the neck down to the nostrils. The muzzle is sepia with a tinge of reddish yellow around the upper lip.

"The neck, shoulders and body range from sepia and black to a rich red. The tail is a bright red with a black tuft. The hind quarters are snowy white or cream-colored, touched here and there with tawny, and marked with purple-black stripes that give them a zebralike appearance. It lives on foliage and twigs."

The three small horns on its skull may at one time have been as prominent as those of the giraffe, but the process of arrested development—or evolution—apparently has set in, and, while promi-

nent, they are worn down and covered with tufts of hair. Scientists believe it is most closely related to the giraffe, and, in fact, may be the animal from which the giraffe has sprung. They ascribe the degeneration of the horns to the fact that it retreated to the dense forests for its own protection, choosing to become wary and run rather than fight. The giraffe, on the other hand, chose the open spaces and developed its horns for protection.

Despite the rareness and shyness of the okapi, it took Heller and his band of pygmy assistants only two months to bag a huge old bull. In the two years of his latest venture into Africa, Dr. Heller and his wife have had more adventure than is usually crowded into a half dozen lifetimes. Besides bearding the fiercest jungle animals in their lairs, they have fought everything from hostile natives to tropical diseases. On one occasion a cannibal chief sent word the expedition could not pass through his territory, and to emphasize the warning captured two of the safari porters, cut off their hands and sent these back to Heller by messenger.

Big Bull Elephant Killed by the Heller-Collins Expedition, and Natives Making Fire with Sticks

Heller and Maj. A. N. Collins, a British big-game hunter who was then associated with him, passed out loaded rifles to the few porters who could shoot, and empty ones to all those who could not, and pressed on. News of the supposedly formidable armament preceded them, and

Not Holding Hands, but a Pet Baboon Hunting Chiggers, a Proof of Real Affection; Below, an Okapi, the Strange and Exceedingly Rare Animal, with Its Coat of Many Colors, Similar to One Heller Bagged

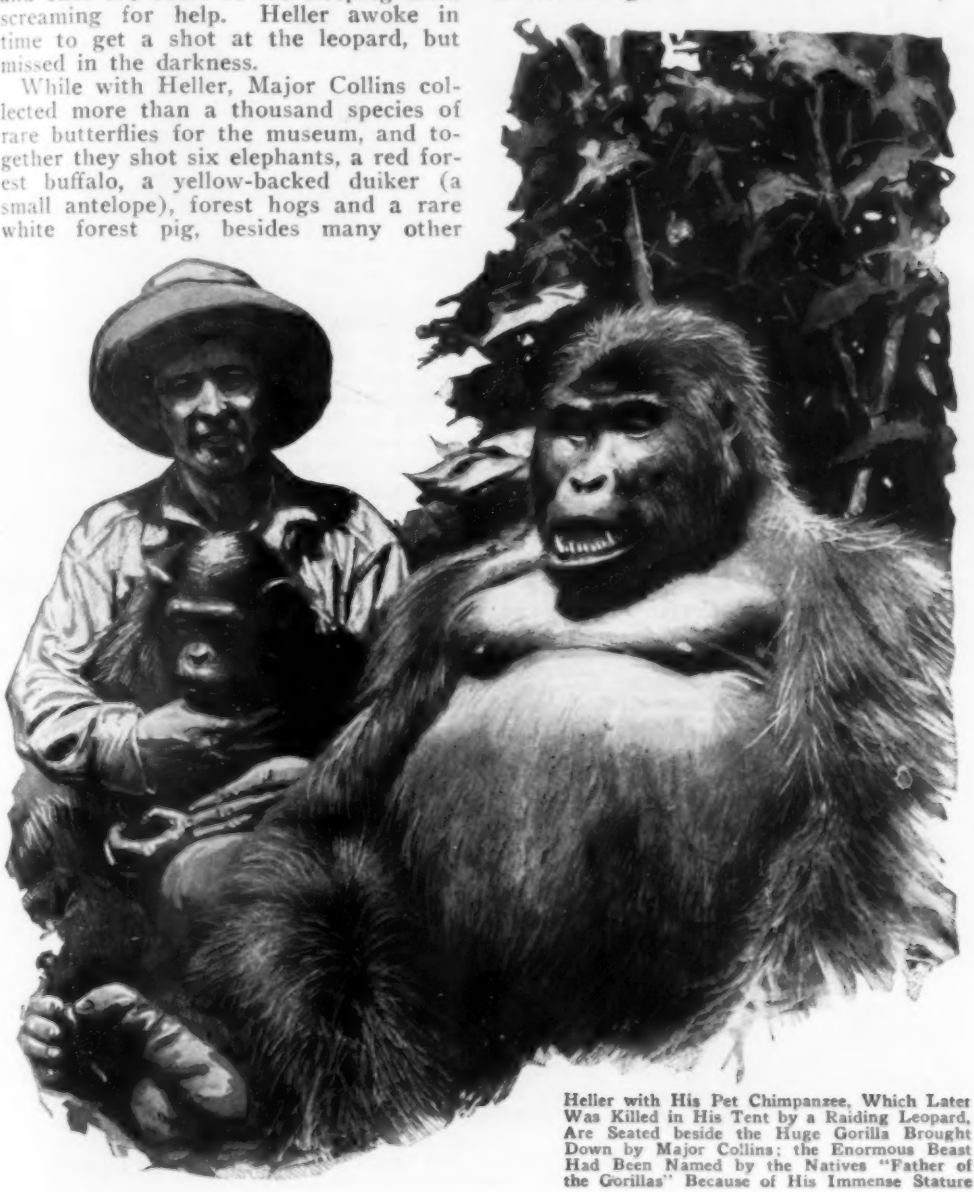
when they reached the chief's village, he and all his followers, save one of his sons, had fled to the forest. The son remained behind to make peace, but was placed under arrest by Heller and carried along as a hostage until the safari were out of the danger zone. The dread sleeping sickness of the Congo has menaced the expedition from the start. The Belgian authorities gave each porter recruited a rigid medical examination, but on the first day out from one village, three of the natives dropped dead on the narrow jungle trail.

In a gorilla hunt staged by Heller and Major Collins last year, they spent several weeks in the big-ape country tracking the animals and getting movies and still pictures at close range. One huge old male got angrier and angrier over the persistent pursuit and a dozen times a day would turn and charge, always stopping just short of the men. Finally he became desperate, and with bloodcurdling roars turned and charged through the jungle brush, which was so dense he could not be seen until he was right on the hunters. Major Collins fired and dropped him at a distance of twelve feet. He was one of the largest ever shot, with an arm spread of twelve feet and a weight of 350 pounds. The hunters obtained two live chimpanzees

and baboons which they trained. They became such pets that they followed the expedition for weeks without being chained. Collins brought his chimpanzee to America and presented it to the Philadelphia zoo, but Heller's was killed one night in his tent by a leopard. The explorer was sound asleep, with the chimpanzee and a baboon curled up together in a corner of the tent, when the leopard sneaked in and grabbed the animal. The frightened baboon leaped across the tent and onto the chest of the sleeping man, screaming for help. Heller awoke in time to get a shot at the leopard, but missed in the darkness.

While with Heller, Major Collins collected more than a thousand species of rare butterflies for the museum, and together they shot six elephants, a red forest buffalo, a yellow-backed duiker (a small antelope), forest hogs and a rare white forest pig, besides many other animals. Another feat of the expedition was the climbing to the snow line of Mount Ruwenzori, a 16,794-foot peak which rears its lofty head only a few miles north of the equator. Heller reached snow at 12,000 feet, and there, looking down on the steaming equatorial jungle, suffered winter cold within sight of one of the hottest places on earth.

Heller became an explorer and naturalist twenty-five years ago, and is hailed by Doctor Osgood as the greatest naturalist-hunter living.



**Heller with His Pet Chimpanzee, Which Later Was Killed in His Tent by a Raiding Leopard, Are Seated beside the Huge Gorilla Brought Down by Major Collins; the Enormous Beast Had Been Named by the Natives "Father of the Gorillas" Because of His Immense Stature**

Future Generations May See in the National Museum How Present Age Wove Cord-Tire Fabric

## LOOM FOR WEAVING TIRE CORD PLACED IN MUSEUM

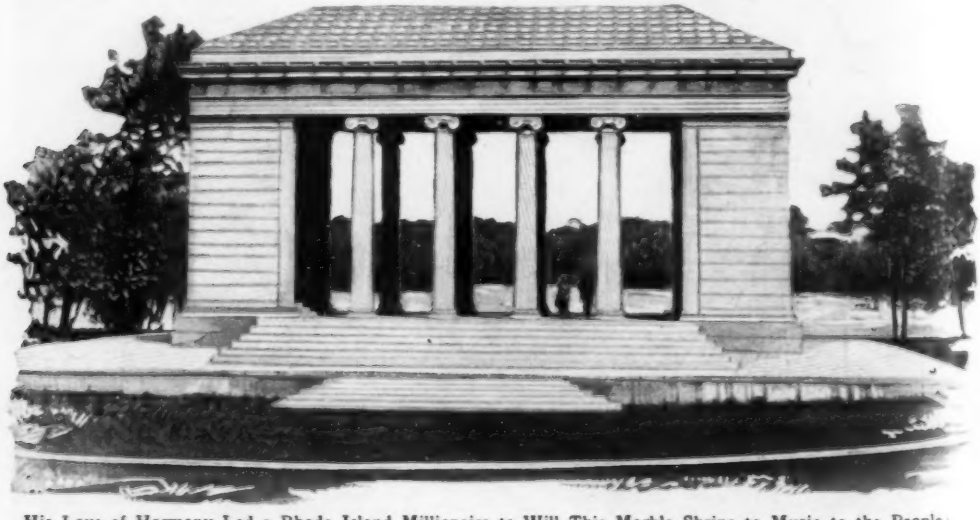
Among the latest inventions to be placed on exhibit in the National museum in Washington is one of the looms for weaving the cord fabric used in auto tires. The strands are in position, and a portion of the completed work is left on the curved section that shapes the covering to illustrate the process of manufacture.

## MARBLE MUSIC SHRINE BRINGS JOY TO THOUSANDS

Music's history since 500 B. C. has been engraved in golden letters on the walls of the Benedict Music Monument in Roger Williams park, Providence, R. I. The structure, built on the lines of the Parthenon, is of white marble and is set in a grassy glade which forms a natural amphitheater, at times holding 50,000 persons. Orchestras, bands and vocalists entertain the audiences from the steps and interior of the monument.

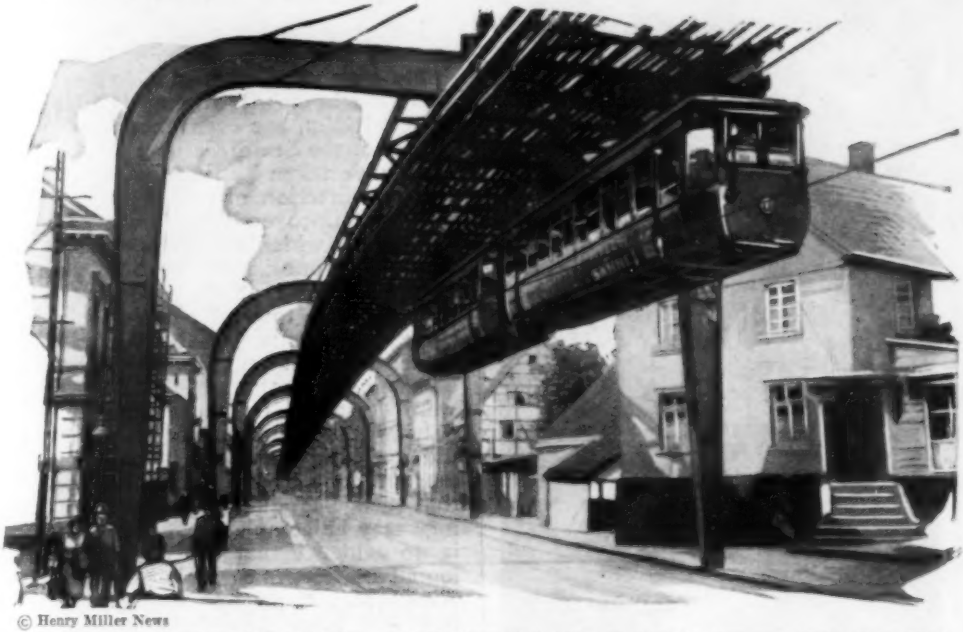
## BIRDS AS WEATHER PROPHETS ABLE TO FORETELL STORMS

That birds are able to perform feats that are impossible to human beings has long been known to science. They have, for instance, a most marvelous sense of direction. This cannot be put down to memory, for young birds reared in England will go straight to the same African haunts to which their parents went weeks before them. But it is as weather prophets that birds excel, according to an English naturalist. Swallows, martins and swifts, he says, will tell if the following day is to be fine. If they are flying really high, say 500 to 1,000 feet above the ground, a whole week of sunshine may be expected. If they are only fifty feet high, the outlook is doubtful. But if they skim a few feet above the ground, rain is certain. A tame raven invariably slept on the southwest porch of a home. Twice in two years, it changed to the northwest side, and both times a terrific gale blew from the southwest. When a wood filled with singing birds is suddenly silenced, a thunderstorm is usually due. It often is observed, too, that if migrating birds fly north instead of south late in fall, a mild winter may be expected.



His Love of Harmony Led a Rhode Island Millionaire to Will This Marble Shrine to Music to the People; Many Thousands Enjoy Concerts Played in the Rotunda

# LATEST IN ELEVATED TRAIN CONTROLLED BY CABLE



© Henry Miller News

**Suspended from Overhead Track, Trains on Cable-Controlled Elevated Line in Germany Make Fast Time While Supports, Set on Curb, Relieve Congestion and Admit More Light to Street**

For the purpose of saving the expense of one track and a third rail a suspended elevated railway system is being used in interurban service between two German cities. The train, made up of two cars, hangs on a rail on the under part of the elevated structure. Power is furnished by a cable in contact with the top of the car.

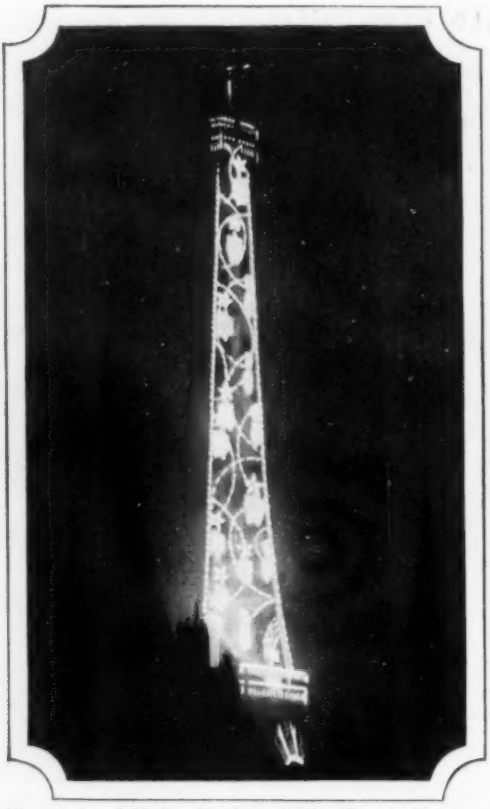
## HUNDRED POUNDS BRIAR MAKE ONE PIPE

Few smokers realize that it takes about 100 pounds of briar to produce a pipe free from flaws and of the best quality. The material is gathered in the forests around the Mediterranean, especially in Corsica, Italy and Algeria, where it grows as a spindly shrub about fifteen feet high. The root is round and about the size of a coconut. This is sawed up into slabs, boiled to season it, and then left in the mountain air for several months to dry before it is cut into small blocks. From 600 pounds of the root, only about six first-quality pipe bowls can be obtained. The rest is unsalable or goes into inferior pipes. Boxwood, pear and cherry have been used as substitutes for briar but only cherry wood has been greatly popular.

**Special Gears on Mower Make Pedaling Easy**

## FOOT-PROPELLED LAWN ROLLER

Foot power drives a cycle lawn roller, so carefully geared that although the rolls and machinery weigh several hundred pounds, a slender woman may operate it. From the pedals, chains transfer the force to the heavy rear roller. Another cylinder in front is used both for rolling and steering, the latter being done through a shaft running from the handlebars. The machine is designed mostly for use on fairly small grounds.



Thousands of Bulbs Used to Light French Tower; Government Gets Big Sum from Advertiser

## LIGHT EIFFEL TOWER AS AD FOR AUTO FACTORY

Thousands of bulbs are being used to illuminate the famous Eiffel tower in Paris, recently leased for advertising purposes to a French automobile manufacturer who paid a huge sum to the government for the use of the "world's tallest structure." From almost every part of the city the tower can be seen when the lights are on. The giant framework, built in 1889 for the Paris exposition, rises to a height of 984 feet. Visitors from all parts of the world ascend to the crow's nest, by foot or elevators, to enjoy the view of the French metropolis and surroundings it affords.

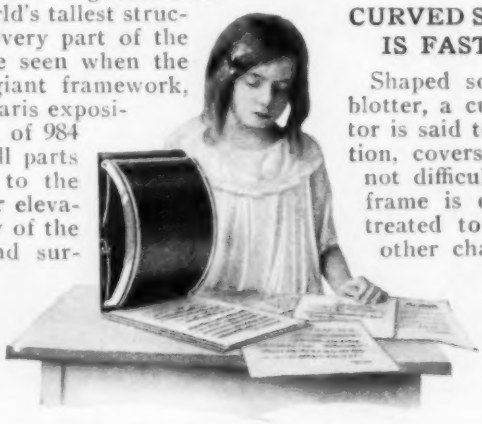
¶Timing an echo from a plane to the ground is the latest means of estimating the height of the craft.

## LOST BIBLE CITY UNCOVERED ON THE SEA OF GALILEE

Lost to men for many centuries, with its very location a matter of dispute, the Bible city of Capernaum, where Jesus made His home after the men of Nazareth rejected Him, has been uncovered on the shores of the Sea of Galilee. The excavation, undertaken by Franciscan friars under the direction of a British archaeologist, has uncovered the ruins of a fine synagogue which the excavators believe is the very one in which Christ preached before, angered at the infidelity of the people of the town, He exclaimed: "And thou, Capernaum, which art exalted unto heaven, shall be brought down to hell." The ruins show the synagogue and the city were destroyed by an earthquake, probably in the second century, so that the city did not long survive Him. Despite the damage done by the quake, it is believed that the synagogue and some other buildings may be completely restored, as there is no evidence that the ruins were ever looted and stones carried away to be used elsewhere. Many fine examples of pottery and other household utensils have been found. As a result of the war, historical excavations are proceeding rapidly at many places in Palestine. Under the Turkish rule, it was very difficult to obtain permission to open historical mounds to get at the ruins, and even when permission was obtained from the government, the cost was excessively high, since myriads of government officials had to be constantly bribed not to interfere. Under the British protectorate, conditions have changed, and several expeditions are now opening ruins, mounds and towns in various parts of Palestine.

## CURVED STENCIL PRINTER IS FAST DUPLICATOR

Shaped somewhat like a desk blotter, a curved stencil duplicator is said to permit rapid operation, covers a wide area and is not difficult to handle. The frame is constructed of wood, treated to prevent warping or other changes under different temperatures. Stencils are easily inserted and ink is supplied through a pad of fine wool covered with a closely woven cotton fabric.



Using Blotter-Shaped Duplicator for Stencil Copying

# Three Miles for Every Meal on Wheels

## Dining Cars Are Run That Distance to Serve More than Thirty Million Persons Every Year

By PAUL PADDOCK

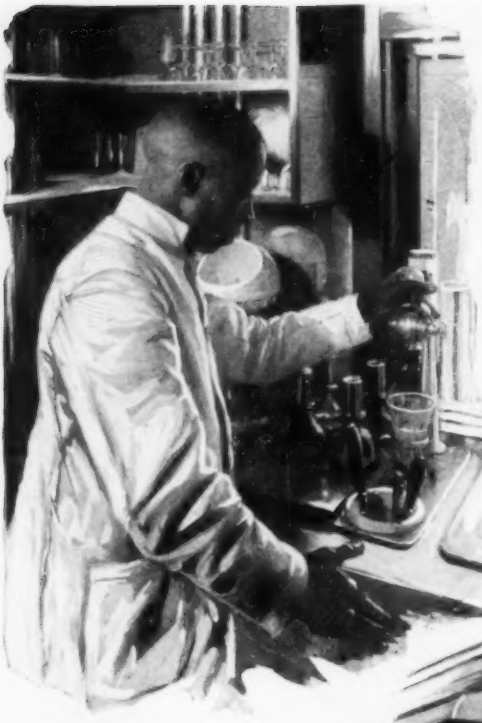
MORE than 80,000 travelers are served daily in the 1,500 dining cars on American railroads. The average check is approximately one dollar, but each meal actually costs about $1.35, not counting interest on capital invested in the car or depreciation.

These figures are based on reports from forty roads, which showed that last year over 30,000,000 meals were served at a loss of approximately $10,500,000. This is explained by fluctuating patronage, high upkeep costs and the limited time each day a diner is in service.

Food supplies represent slightly more than fifty-one per cent of the total expense. Ten thousand stewards, chefs and waiters draw wages totaling over $11,000,-

Photos Courtesy Santa Fe R. R.

**Waiters Passing through Wide Serving Compartment in the Latest Type of Dining-Car Kitchen, and Cashier Totaling Checks as Is Done in a Restaurant**



a year's service, diners on the Pennsylvania lines are hauled about 100,000 miles, or three miles to each meal. Every eighteen months they are shopped for overhauling and repairs at a cost of from five thousand to seven thousand dollars.

Plain foods, the eighty-five-cent, dollar and-a-quarter and dollar-and-a-half meals are increasingly popular, officials say, but protests have always followed when fancy articles are taken from the menus entirely. This illustrates one of the problems that faces the steward. He must stock his car to meet the demands of both the epicure and the man of simple tastes. Experience is his chief guide and he relies on the law of averages to a large extent. For instance, he knows that out of every hundred persons, about eighty-five will want coffee and fifteen tea; thirty-five will ask for roast beef, with chicken, fish, chops and steaks following in the order named. Fruit leads

000, representing about forty-six per cent of the total outlay. Fuel, water, ice, stationery, printing, medical examinations (two are given each year to every member of the crews), telephone, laundry and room rent for employes compelled to lie over between runs, are among the additional items that must be paid for out of every dollar received for a meal.

The whims of the American appetite have been studied since 1868, when the "Delmonico," the first exclusive dining car in the world, was placed in service on the Alton railroad. Lighted with candles, the floor covered with oilcloth, the ceiling of painted canvas and with only a hole in the kitchen wall through which foods were handed to the waiters, the car gave little promise of the modern, all-steel palaces on wheels that cost $50,000 each, seat from thirty to thirty-six persons at once and carry a crew of from seven to thirteen to serve almost anything, from caviare and truffles to beans and spaghetti. In the course of

Courtesy Penna. R. R.

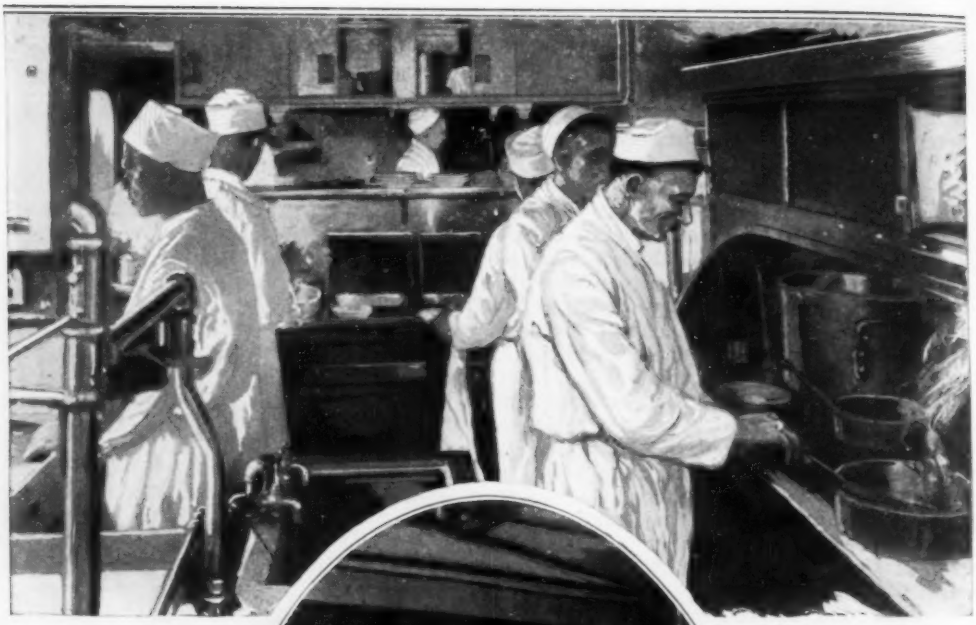
**Beverages and Ices Are Served Patrons, While Traveling, Directly from a Completely Equipped Soda Fountain Installed in the Club Car; Below, Waiters and Chefs Loading Dining Car with Food Supplies for the Day**

all other dishes among the desserts, and then come puddings. Apple is the favorite pie.

What the captain is to a ship, the steward is to the diner. He is absolute master of his crew. He orders every article of food and is responsible for all stocks on his car, including the 150 kitchen utensils, 1,000 pieces of crockery and glassware, 800 pieces of silver and 900 tablecloths and napkins, with which the modern car that seats thirty-six persons is equipped. He must always order sufficient quantities to insure against running short on the road, the "unpardonable sin" in the railway world.

The steward never knows, except on special excursions and similar occasions, whether he will have ten patrons or a hundred, but he must be ready for the larger number. Sometimes his foresight wins him the undying gratitude of passengers. Only a short time ago, a Chicago, Milwaukee and St. Paul diner fed hungry passengers over a forty-eight-

Dining-Car Chef, the Skilled but Seldom Seen Servant of the Hungry Traveler, and Interior View of a Club Car That Furnishes Refreshments, Rest and Recreation



Courtesy Santa Fe R. R.

Roomy Kitchen of Recently Patented Dining Car, and Cigar Counter, an Extra Luxury for Traveling Smokers

hour delay when the trains were stalled by a land slide in the Rockies. Hours before the train is scheduled to leave, the steward appears in the coach yards, supervises the starting of the fires and the preparation of the car for the run. Housewives who complain that their kitchens are too small, should step inside that of the Broadway limited diner. The floor space is less than twenty feet long and about two and one-half feet wide, but four cooks seem to find plenty of room to broil steaks and chicken at the charcoal-burning stove, bake pies and prepare three or more vegetables for the dinner that will include twenty-four articles and will be ready in less than one hour. The pantry has floor space that measures about four feet by five. Lockers, cupboards, refrigerators and work tables are distributed to save as much space as possible. The latest thing in diners is a patented car recently put into service on the Santa Fe road. Patrons are spared the inconvenience of waiting for their turns in a close passageway, as a club car, adjoining the diner, provides seats for them. The kitchen arrangement permits waiters to circulate through a wide compartment and gather up their food without delay. Besides the customary lounging and card rooms, the club car has a soda fountain and a cigar counter.

## ANTISEPTIC FLUID KILLS GERMS WITHOUT ACTUAL CONTACT

An antiseptic which can pass its healing properties through a quartz tube like X-rays and kill bacteria without ever coming in actual contact with them has been discovered by two French physicians. The material, hypochlorite of sodium, has been used as a germ destroyer for a long time, but the French scientists found that when a dilute solution of it was placed in a quartz vessel and then inserted in a bowl of contaminated fluid the solution still acted as a powerful germicide. The discovery is considered particularly important as it permits the killing of germs in such liquids as milk without affecting their purity through dilution with the salts themselves. While the exact reason for the action of the liquid in the tube remains unknown, it is believed further research work will show a connection between the healing properties of the antiseptic and the ultraviolet rays which are now known to be responsible for the germicidal and healing action of sunlight. Quartz tubes will transmit ultraviolet rays, while ordinary glass will not. M. Philippe Bunau-Varilla, one of the experimenters, advances the hypothesis that the molecule of sodium hypochlorite in attacking organic matter, emits rays analogous to the ultraviolet rays of the sun, and that these pass through the tube.

## RUBBER-LINED BOTTLE CORK ALSO SERVES AS OPENER

Mineral waters and other bottled goods can be kept in fresh condition by means of a combination cork and opener now on the market. It has a notched ring in the top for lifting off the metal cap, and its

Rubber-Lined Stopper Keeps Effervescent Beverages Fresh in Opened Bottles; It Is Also an Opener

bottom part is bell-shaped and lined with rubber, so that it can be slipped tightly over the top of the bottle.

## ELECTRIC DRIER FOR THE HAIR ALSO SERVES AS HEATER

After a shampoo, the hair is quickly and thoroughly dried with a small electric heater attached to a lighting socket. As

This Electric Hair Drier Will Serve Also as a Bed Warmer; Screen Prevents Burns

there is no air blast, the hair is not tangled and there is little danger of taking cold. A screen over the heating unit prevents burns. It may also be used for warming beds and heating rooms and adds comfort to the morning shave in chilly weather when hung on the bathroom wall.

## WHY TIMEPIECE IS A WATCH

Few who carelessly glance at their timepieces realize how the watch came to be called by that name, but word students teach that it is derived from an ancient symbol meaning "to be on watch." From this it came to mean a special period of time at which the soldier stood guard. In the Gospel of St. Mark appears the phrase "about the fourth watch of the night." Centuries ago a candle was marked in sectional lengths, to keep tab of the hours as they passed. Naturally when a timepiece was invented to replace this crude beginning, it slipped into possession of the name it now bears.

¶Dust tossed up twenty miles by eruptions of the volcano Krakatao remained in the air for a period of three years, scientists have announced after a study of the colors of the sunset.

# SIXTY MILLION DOLLAR DEPOT COVERS THREE ACRES

Interior of Waiting Room Showing Ceiling 111 Feet High; Exterior View of Concourse and Main Building Which Are Connected by Wide Passageway

Besides the usual ticket offices, waiting and baggage rooms, Chicago's $60,000,000 union station contains shops, restaurants and cab stands all on one level. It handles more than 50,000 passengers, 300 trains and 400 tons of baggage daily and covers about three acres. There are two main parts to the building, connected by a wide passageway, a concourse with twenty-four gates leading directly to the trains and the main structure which includes the waiting room. There are 17,000 tons of steel and more than 200,000 cubic feet of limestone and granite in the structure, which rests upon 449 cylindrical piers from four to ten feet in diameter and reaching more than sixty feet below the level of the Chicago river. Special features of the station are a large conference room and separate platforms for passengers and baggage at the trains. The terminal is shared by four railroads, the Pennsylvania; Chicago, Burlington & Quincy; Chicago, Milwaukee & St. Paul, and the Chicago & Alton.

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¶Popular Mechanics Magazine does not publish the name of maker or seller of any device described in its pages, but this information is kept on file and will be furnished free by addressing our Bureau of Information.

## GREATEST ARTIFICIAL LAKE HAS SEVEN HUNDRED MILE SHORE

For the triple purposes of power, frost killing and flood control, Cherokee Bluffs lake, said to be the greatest artificial reservoir in modern times, is being rushed to completion on the Tallapoosa river in Alabama. It covers 40,000 acres and has a shore line of more than 700 miles. The lake will impound 530,000,000,000 gallons of water as against only 420,000,000,000 held by Roosevelt dam reservoir, largest man-made water holder prior to this. Presence of the vast surface of water will tend to keep down frost in many miles of fruit orchards near by. Three huge electric generators, each driven by a 45,000-horsepower turbine, will develop power. Holding back the water will help end floods on the Tallapoosa and Alabama rivers. Work is expected to be completed during 1926.

## WIRE ROLLER FOR CONCRETE GIVES SMOOTH SURFACE

In finishing concrete surfaces, a wire roller now on the market, pushes the coarse stones down and squeezes the finer material upward as well as ridding the material of excess water. On wide walks or floors, the roller may be fitted with a long handle or a rope by which it can be

Smoothing Concrete with Roller That Presses Down Small Stones and Has Rope Handle

pulled back and forth so that it will not be necessary for workmen to step on the soft concrete.

## HOME COMFORTS IN AUTO BED WITH KITCHENETTE CASE

With its occupants high and dry above ground moisture, an auto bed for week-end and longer vacation trips is being used by two English girls.

Auto Made into Bed of Full Length by Arrangement of Cushions

Ingenious placing of the seats and their backs to make a full-length bed, together with convenient stowage of pillows, sheets and blankets in daytime, gives all the comforts of home and none of the troubles of tent camping. In a suitcase is carried a complete kitchen outfit and small stove. Summer nights a netting can be thrown over all to keep out mosquitoes, and in inclement weather or to guard against prowlers, the top is raised and the removable windows hoisted and locked.

## FARM POPULATION DECLINES U. S. STATISTICS SHOW

Farm inhabitants of the United States decreased by some 180,000 last year, according to figures prepared by the department of agriculture. The rural population on January 1, is placed at 31,134,000 compared to 31,316,000 a year earlier. The decrease was not universal for the whole country, however, as New England and the south Atlantic states experienced increases, while other divisions showed losses, with the mountain states leading in the decline. While 2,075,000 persons left the farms last year, 1,396,000 returned to them. Although the balance is still in favor of cityward migration, the back-to-the-farm movement is increasing.

## DOG-TEAM TAXI FOR CHILDREN HAS MONKEY DRIVER

One of the amusements for children along the Riviera is a ride in a two-wheeled covered taxi hauled by a team of dogs, which is driven by a trained monkey. Passengers may ride in the main compartment of the vehicle which has windows in front and at the sides, or may sit with the "teamster." The monkey has been taught to handle the reins in realistic fashion and the dogs are securely harnessed between double shafts.

© Keystone

**Dog-Team Taxi, with Monkey for Driver, Furnishes Fun for Children and Grown-Ups along the Riviera**

## MYSTERY IN HABITS OF FISH TO BE SOLVED BY TAGS

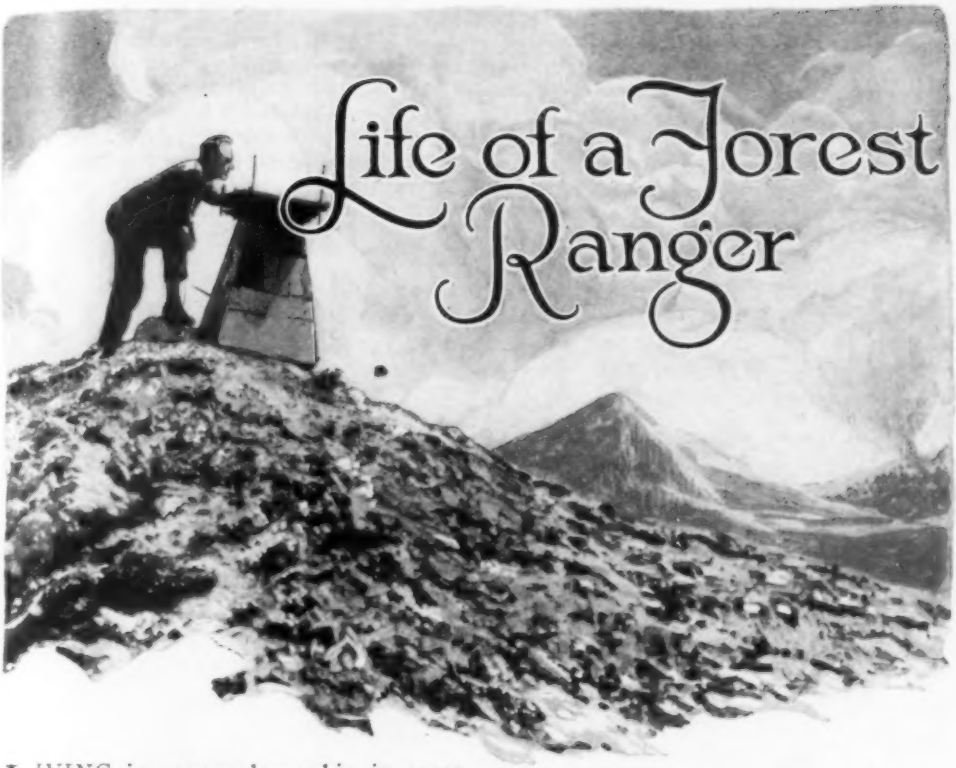
For many years, the mysterious movements of schools of mackerel have puzzled fishermen in north Atlantic waters. Places where the fish abound one season, may be barren the next, and while they generally migrate in a south-to-north direction annually, their habits are so uncertain that fishermen are unable to outguess them. Government agents now propose to keep track of the mackerel by means of identification tags. Numbers of the fish will be caught, labeled and released. By recapturing them, it is expected that some clue may be gained as to their travels.

## TEACHERS NOW PICK SINGERS WITHOUT HEARING VOICE

As the result of a theory of voice advanced by an eastern dentist, teachers may be able to select singing students without hearing them produce a note, years of vocal lessons may be shortened by a dental operation and much money now wasted by parents on children who have not the slightest chance of becoming great singers may be saved. This theory maintains that vibrations of the air in the cavities beside the vocal cords and not the cords themselves produce the voice. By taking a cast of the mouth cavity, it is considered possible to determine if the person's oral equipment is shaped correctly for the production of singing notes, or if an operation such as altering the position of the teeth or changing the shape of the mouth arch might remedy matters. Casts have been taken of the mouth cavities of some of the world's leading singers, and from study of these, the dentist has evolved his theory of voice production. By performing an operation on a patient, he is reported to have greatly improved her voice

## ASH TRAY WITH TILTING TUBE EXTINGUISHES CIGARETS

Ash tray and cigaret extinguisher are combined in a convenient accessory that has a rubber base to protect the surface on which it rests. Opposite the match box, there is a tilting tube with a closed end at the bottom. By simply inserting the cigaret into this snuffer, it is immediately put out, sparing the unpleasantness of fumes and the trouble of crushing the stub. The tray is removed from the base for washing.



# Life of a Forest Ranger

LIVING in a cozy log cabin in some grassy mountain meadow beside an ice-cold brook filled with trout, sole boss of a wilderness of forests and mountains frequently larger than some eastern states, protector of all the big game, with saddle and pack horses in the corral and Uncle Sam to furnish provisions and pay one for living there—the life of a forest ranger has an appeal all its own.

But when the dry days of summer come and a lookout on some lofty mountain peak telephones down at 2:00 a.m. that a fire has started in a distant valley, all the romance disappears. For the ranger must leave his bed and, with food and tools in a pack, start out, on horseback or afoot, to cope single-handed with a fire that may be burning over an area the size of New York or Chicago.

And he must reach the scene by dawn, if possible, for just at that hour of the day a forest fire dies down, resting a bit before renewing its attack. It is then that the lone fire fighter has a chance to start digging and back-firing to head it off.

Summer is a period of hard, back-breaking work for the forest guards, while the early spring, late fall and even the below-zero days of winter are the periods when he has time to really enjoy the romance of his life. Even then there is plenty of work to do. The timber must be inspected and that which should be cut marked for the woodsmen who follow. In spring and fall, tree planting and other reforestation work are carried on, insect pests are investigated, telephone lines constructed and maintained; roads and trails for use of both rangers and campers built; dwellings and lookout houses built and repaired; fences erected; water developments, fish and game studied, and in winter a game census is taken.

With 157,000,000 acres of national forests to be looked after—an area slightly larger than the combined states of Oregon, New York, Florida and Pennsylvania, the service finds plenty to do. Most of the forests are in the high mountains of the west, in fact, eleven western states and Alaska contain all but 6,000,000 of the total acreage. The forests there are chiefly pines, firs, spruce, cedar, hemlock and other evergreens, which become highly inflammable in summer. The ground beneath them is covered with the accumulated vegetable decay of the centuries, piles of twigs, dead leaves, weeds, and grass of previous generations frequently making a bed several feet deep.

Rangers Flashing Fire Warning with Heliograph, or Sun Telegraph

the control of the forest supervisor. Each district is presided over by a district ranger, and each ranger may have under him a fire lookout and a fireman, while forest patrols constantly cover the entire area to enforce the laws against

Camp in a Mountain Meadow and, Below, a Fire Truck of the Forests

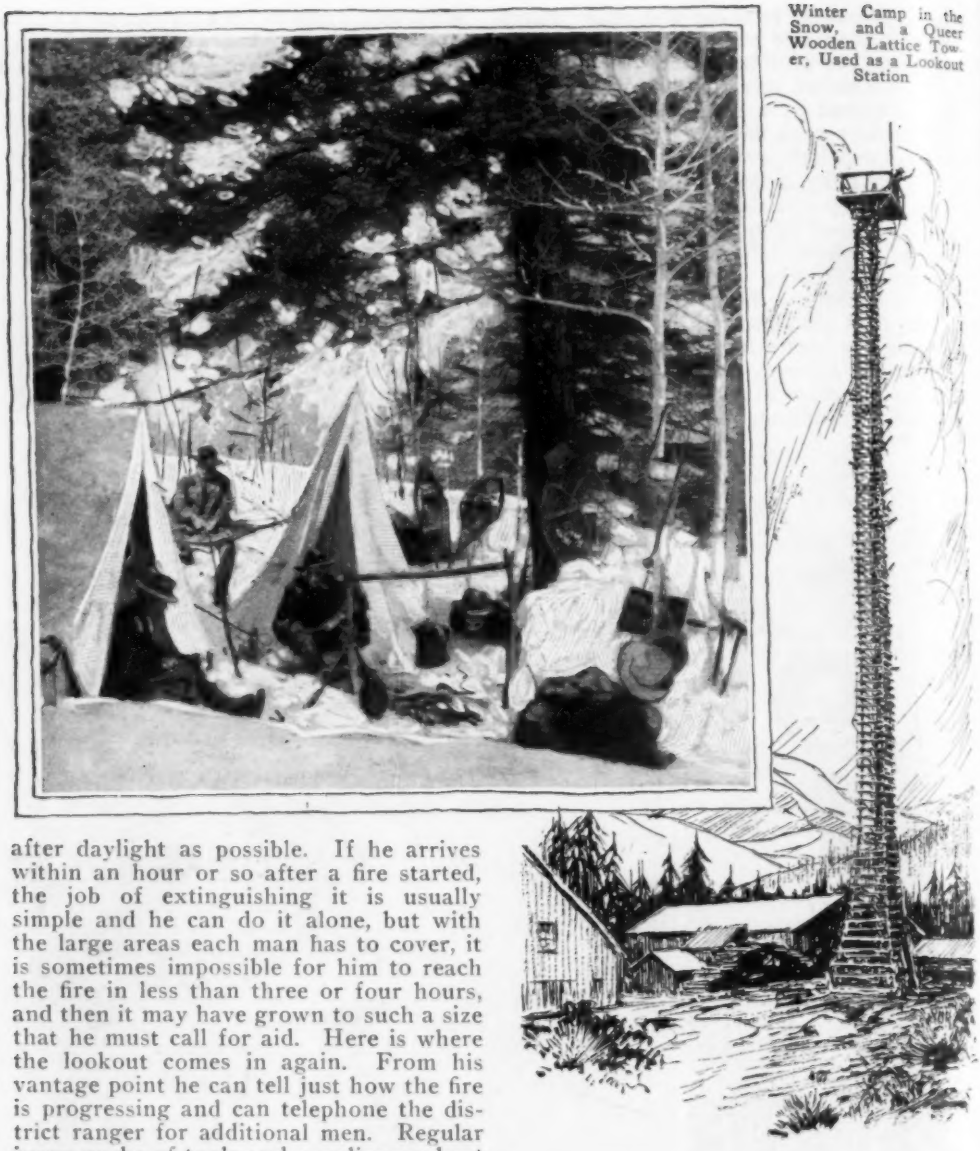
A match or cigaret stub dropped in this debris may start a smoldering fire that will burn quietly for days until a high wind fans it into violence, or a stroke of lightning may fire one tree and start flames sweeping through the woods. Some 6,000 fires are fought each year by the forest service, about forty per cent of them being traced to lightning and the other sixty to careless campers.

Such a start may be overcome, if the fire fighter reaches the scene quickly, but if the fire gets going, it may burn for days or even weeks until a heavy rain extinguishes it. One can often back-fire and end a blaze, but others sweep across thousands of acres, and sometimes take a heavy toll of life. Most of the national forests are divided into districts, under

cutting timber, running too many sheep or cattle on the range, killing game or violating the camping rules.

The lookout has the loneliest job of all. Perched in a tiny house on top of the highest peak in the district, he may not see another person for weeks, though he is in daily telephone communication with all the officials of the district. His job is to keep ceaseless watch for the telltale column of smoke that marks a new fire. When that appears, he proceeds to locate it as accurately as possible. He has a map of his district mounted on the table in his tower, with its compass points properly orientated. On the map is placed a circle, laid off in degrees, and with its center over the spot which represents the location of his post. When smoke is sighted, he takes its bearing and telephones the direction and probable distance to the fireman of the district. The fireman is stationed as nearly as possible in the center of the timber he is to protect. He has a cabin to live in; tools to fight the fire with, and "grub" for three days made up into a pack, ready to sling on his shoulders and start for the fire at a minute's notice. For night travel he is equipped with a miners' lamp and he must get as near the fire as he can, so as to be able to tackle it in the morning, as soon

Telephone Lines Must Be Kept in Constant Repair to Carry Fire Warnings; Above, Fire Crew Digging Down to Mineral Earth as They Start Back-Fire



Winter Camp in the Snow, and a Queer Wooden Lattice Tower, Used as a Lookout Station

after daylight as possible. If he arrives within an hour or so after a fire started, the job of extinguishing it is usually simple and he can do it alone, but with the large areas each man has to cover, it is sometimes impossible for him to reach the fire in less than three or four hours, and then it may have grown to such a size that he must call for aid. Here is where the lookout comes in again. From his vantage point he can tell just how the fire is progressing and can telephone the district ranger for additional men. Regular horse packs of tools and supplies are kept on hand for these emergencies so that no time will be lost assembling outfits.

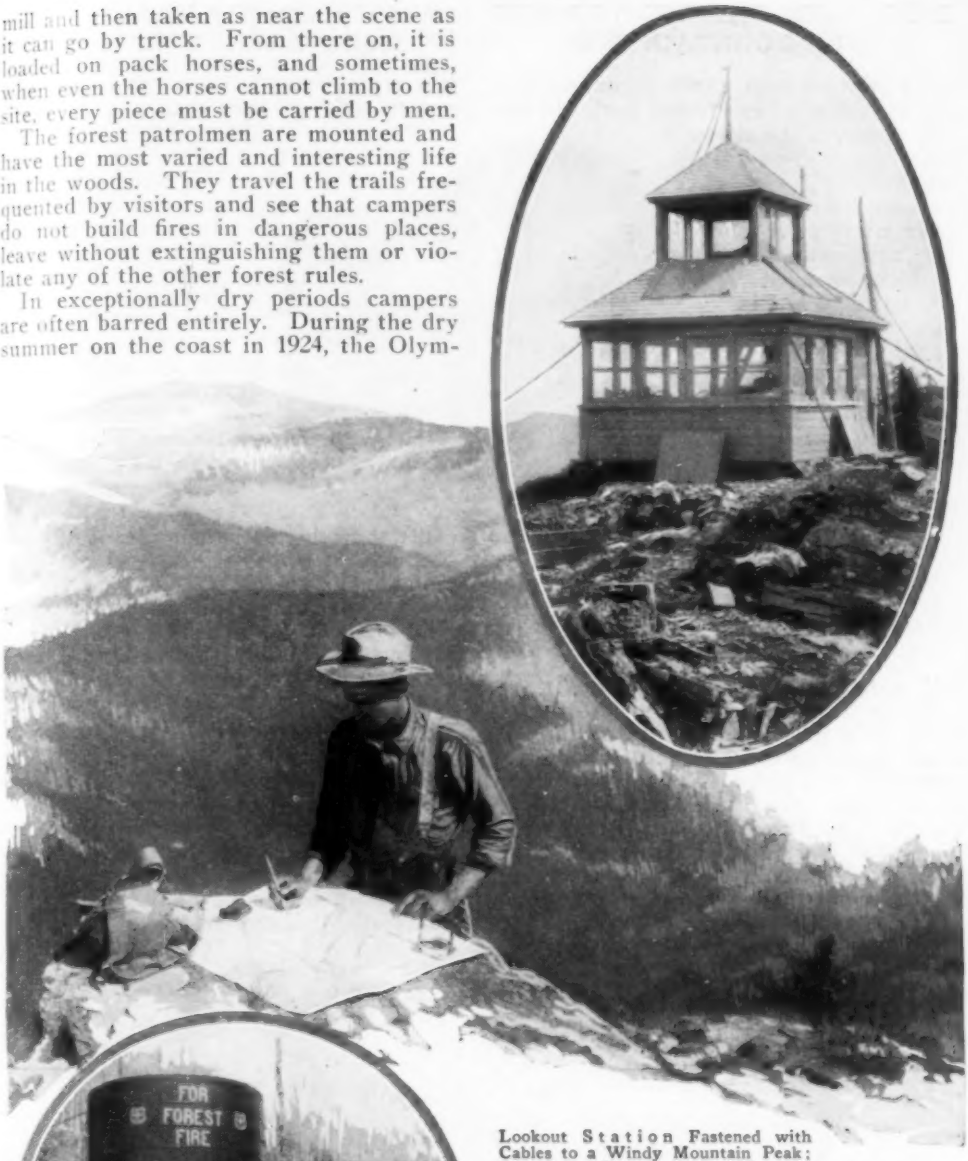
Hundreds of miles of horse and foot trails are kept cleared in the forests to facilitate reaching fires quickly. Even motor roads are now being built and firemen equipped with regular city fire-fighting apparatus. The trench and back-fire remain the stand-bys of the forest ranger, however, and it is here he finds his back-breaking work. He picks out a favorable spot ahead of the fire and digs a trench, from twelve to twenty inches wide, all the way down to mineral soil, which may be anywhere from one to several feet below the surface. Then he back-fires on the side of the trench nearest the fire, and watches that no sparks cross to the other. The back-fire, if successful, meets the advancing blaze and the two burn themselves out together.

To be a successful ranger, a man must have a working knowledge of many trades, from stringing telephone wires to building bridges. Getting some of the lookout nests on their mountain tops is one of the hardest jobs he has. The lumber is all cut at the nearest valley planing

mill and then taken as near the scene as it can go by truck. From there on, it is loaded on pack horses, and sometimes, when even the horses cannot climb to the site, every piece must be carried by men.

The forest patrolmen are mounted and have the most varied and interesting life in the woods. They travel the trails frequented by visitors and see that campers do not build fires in dangerous places, leave without extinguishing them or violate any of the other forest rules.

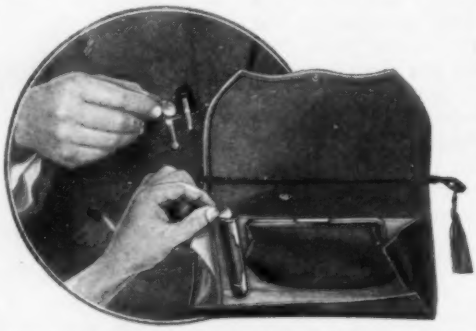
In exceptionally dry periods campers are often barred entirely. During the dry summer on the coast in 1924, the Olympian mountains were practically closed to visitors. Few could get permits to enter, and then only to pass from one ranger station to the next. Their camping sites were specified and they were forbidden to smoke. Over the trails they took, the patrolmen were sure to pass within a few hours, and a single match or cigaret stub was sufficient to cause them to speed up, arrest the culprit and take him to the nearest judge.




Lookout Station Fastened with Cables to a Windy Mountain Peak; Locating a Distant Smoke Cloud by Compass and Map, and a Fire Truck Filling at Its Water Supply

## DIME BANK FITS VEST POCKET LIKE FOUNTAIN PEN

To outward appearance a fountain pen, but in reality a vest-pocket bank for saving dimes, a handy container is being distributed by midwestern banks to their customers. The article is made of nickeled metal, and has a clip at the top whereby the tiny bank, holding $4, may be held safely in the vest pocket or in a woman's handbag. The slot is in the top and by slanting the coins in stacking them, the actual width of the holder is less than that of the ten-cent piece.



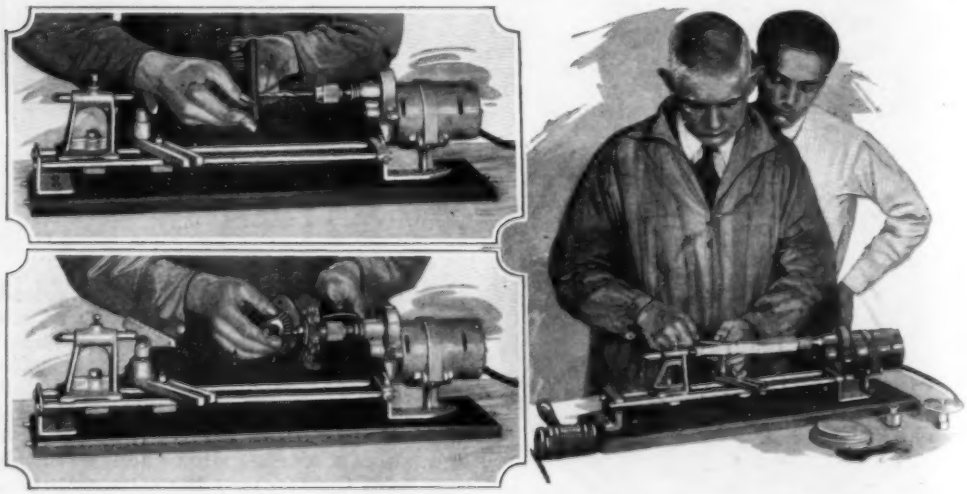
Inserting Dime in Bank Attached to Pocket, and How Holder Is Carried in Purse

## FULL WORKSHOP IS COMBINED IN A SINGLE TOOL

A complete workshop, combining everything from a wood and metal-working lathe to a portable electric drill in one small outfit and which can be carried around in the hand, has been placed on the market. It includes power-driven grinder, buffer and wire brush, as well as a circular saw, in addition to its other features, yet the entire outfit is contained on a base only twenty-five inches long by six inches wide, to which is fitted a metal cover with a carrying handle. The lathe bed, capable of taking work twelve inches long with a six-inch swing, is mounted directly on the wooden base, with the power unit—a back-geared motor—attached to the lathe head. A separate revolver-type handle is provided which may be attached to the motor and the entire power unit lifted off to make a portable electric drill. The motor has an extension cord for attachment to any light socket. A reversible tailstock with both wood and metal-turning centers is supplied, while the other lathe equipment includes a chuck, spur center, faceplate, parting tool and gouge chisel. To convert the outfit into a power-driven saw, a small, rigid metal table, on which is mounted a five-inch circular saw, is clamped to the lathe rails.

## RUBBER BASE FOR TELEPHONE

Flexible rubber instead of felt for the telephone base is said to serve better as a shock eliminator and assure a clearer conversation as well as prevent scratches and mars on polished surfaces. It is manufactured in brown or green and fits the standard-size instrument.

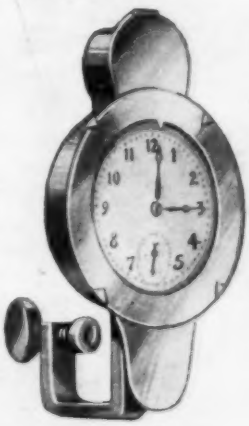


Versatile Tool in Operation, Doing Drilling, Buffing and Wood-Turning; the Motor Is Connected to a Lighting Socket and May Be Detached to Form a Portable Electric Drill

## COW PONIES KILLED TO SAVE THEIR FOOD FOR SHEEP

Montana ranchmen are joining to wipe out of existence 400,000 wild horses that are denuding the ranges of grass needed for sheep and cattle. The old-time cow pony, its use nearly gone as fences split up the old free plains, has been officially sentenced to death by the state. It is figured that the savage steeds of this one state consume feed worth $109,000 yearly and sufficient to keep 2,000,000 sheep alive. Other states are also working to eliminate them. Arizona and New Mexico ship theirs under a special freight rate as "chicken feed" to Petaluma, Calif., world poultry center. About 8,000 head are sent to an eastern port, whence the choicest portions of the body go to Europe for human food, and the rest is ground into dog food. In the roundup the ponies are driven into wide corrals, then roped and their throats cut, a business that the old-time cowboy refuses to take part in. The hides are ripped off and the bodies, piled high, are burned with the aid of oil. It is figured that in a few years the cayuse or broncho, as it is variously known, will have disappeared save from the ranks of those riding for professional rodeo exhibitions and circuses, and those employed in motion-picture work.

## WATCH CASE ON AUTO DASH RECORDS DRIVING TIME



The motorist's pocket watch is made to serve as dash clock by a holder which may be clamped to the instrument board of the car by means of a thumbscrew. The timepiece is inserted by raising the front of the case and snapping it shut. A rotating band with arrowhead, when brought to the proper position, marks the time of starting and so gives a record of the duration of the trip.

Sawdust, mixed with oil and sowed like seed in shallow pools and ponds, is being used to combat mosquitoes.

## PIANIST WEIGHTS HIS WRISTS TO STRENGTHEN HANDS

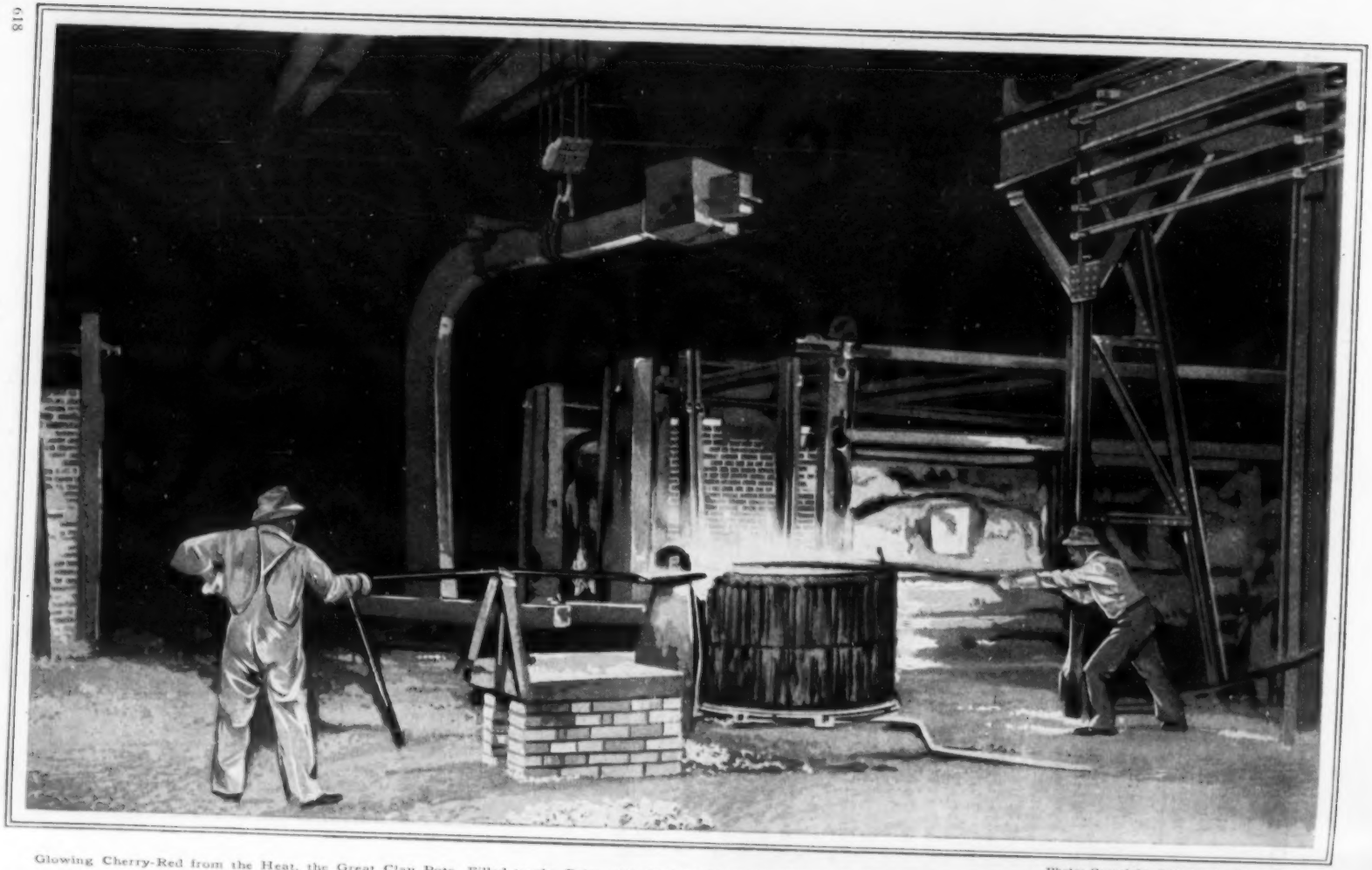
Five-pound weights, attached to the wrists, are being used by a young Ameri-

Practice on Piano Becomes Gymnastics with Five-Pound Weights Attached to Wrists

can pianist in practicing, to develop the muscles of the hands and fingers and keep them supple. Discovery of the beneficial effect came by accident. The youth was in a concert hall one winter night, waiting to hear a prominent Russian artist. Soon the manager reported that the foreign pianist would be unable to play. The American agreed to substitute. He hurried backstage to warm and loosen the muscles of his hands and fingers, and noticed two heavy paint cans. He hung one of these on each wrist and was surprised at the way his circulation speeded up. Practical application, he decided later, was to use weights in strengthening the muscles.

## OLD SNAKE YARNS REFUTED

Stories about snakes that curl themselves into hoops and roll toward their victims or that break into many pieces and wriggle off to escape, are fables according to biologists of the department of agriculture, for no such reptiles exist. The so-called stinging snake is also a myth, they declare, crediting the origin to the existence of a snake with a sharp-pointed tail. The jointed snake, it is said, is nothing but a harmless lizard that has the ability to drop its tail when it is in danger of being caught by that member.



Glowing Cherry-Red from the Heat, the Great Clay Pots, Filled to the Brim with Molten Glass, Are Drawn from the Furnace by Huge Electric Tongs, Then Mashed Workmen Skim Off the Impurities

Photos Copyright, Pittsburgh Plate Glass Co.

# The Romance of Glass

Glowing Cherry-Red from the Heat, the Great Clay Pots, Filled to the Brim with Molten Glass, Are Drawn from the Furnace by Huge Electric Tongs. Then Masked Workmen Skim Off the Impurities

Photos Copyright, Pittsburgh Plate Glass Co.

AN ancient crystal gazer, peering into his mystic sphere in an Egyptian temple, many centuries before the Christian era foretold the future, and in predicting it, concentrated men's interest in the strange material from which the bauble was made.

But the seer failed to discern in that future the day when the glass of his crystal, born in the fusion of soda and sand, would be rolled into plates for windows, blown into bottles and flasks and jars, or that the demand for windows in motor cars would result in the invention of a radically new method of making the product, improving on a process that had changed but little in more than 2,500 years.

That is the romance of glass, an accidental discovery, according to Pliny, of some Phoenician sailors cooking their dinner on the sands, which founded a business that now employs 80,000 Americans and turns out a product valued at $400,000,000 annually. Pliny's tale may be true or only a plausible fancy, but true or false, in some such chance discovery beyond human record or tradition one of the greatest of modern industries had its origin.

From such a humble start glass making produced "The Window of Paradise" of Rheims cathedral, the wonderful glass ornaments of ancient Egypt and Assyria, the fragile, beautifully colored Venetian glass, the first microscope and spectroscope and camera, and on down to the windows and bottles and the automobile windshields of today.

The glass mosaics of Egypt and the rare Venetian and Roman glassware, as well as the great cathedral windows of the Middle Ages were all wrought in colored glass, for the manufacture of transparent glass on a commercial scale is a comparatively modern achievement.

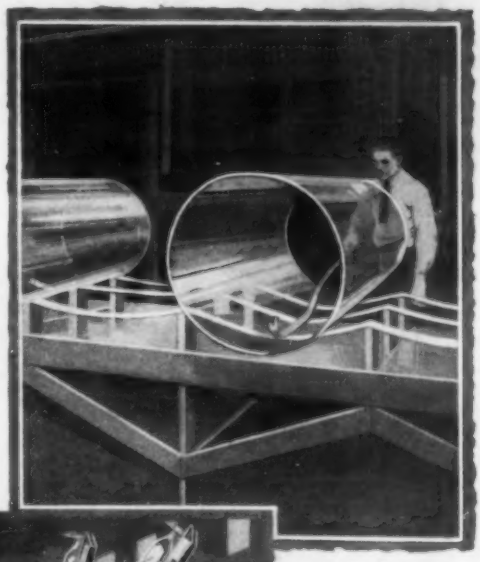
Despite the vast progress made in the last hundred years, more than three-fourths of all the plate glass produced in the United States today is made in virtually the same way as that pictured on the walls of the tombs of Memphis and Beni Hassan. The materials are dumped into clay pots, the pots heated for hours in furnaces, and the molten material, skimmed of its dross, poured onto tables and rolled into thick rough sheets. The pots and furnaces are bigger because great electrically driven cranes are available to handle the heavier containers, the rolling tables are bigger because power is available to move the giant rollers, and the grinding and polishing machinery is all of modern invention, but the process is basically the same.

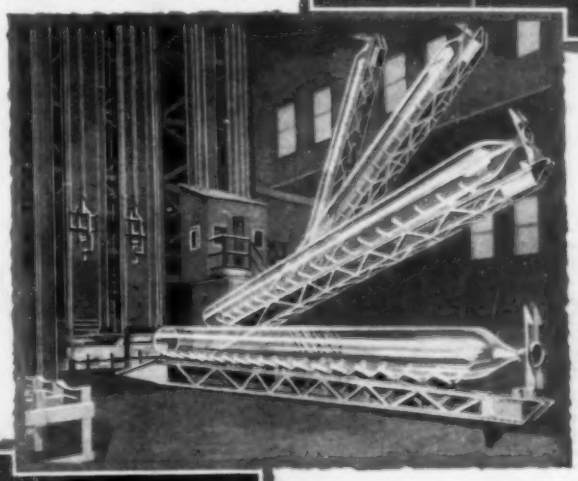
Men still dip up molten glass "gathers" on the end of blowers' pipes and with

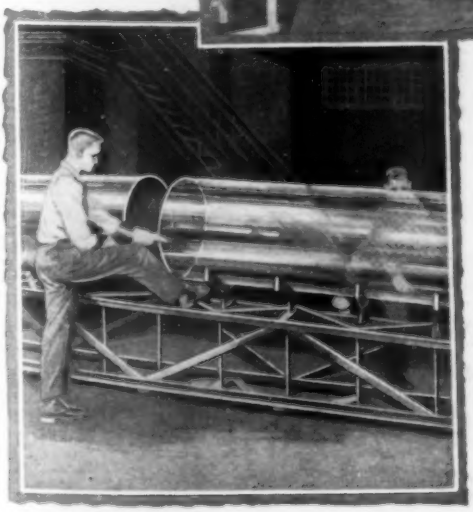
Huge Sheets, Polished on One Side, Are Stood on Edge While Workmen with Long-Handled Mops Wash Off the Plaster Which Held Them to the Surface of the Polishing Table, Using a Bath of Muriatic Acid to Remove the Adhering Coating Before the Sheets Go Back to the Polishers

lung power expand the incandescent bubbles, though compressed-air blowing is rapidly displacing them. In all of the commercial plate-glass plants men are still tramping out pot clay with their bare feet and building up the pots by hand, though within the last half dozen years one automobile maker, who uses one-fourth of all the plate glass made in the United States, has developed a process by which pots are dispensed with, and raw material thrown into a furnace pours out as a steady stream of molten glass, is cooled, ground and polished almost without human hands touching it.

The terms "plate glass" and "common window glass," contrary to popular belief, have nothing to do with the thickness of the material, but only with the way in which it is made. Common glass is blown first into huge cylinders, these are cut into sections, the sections split down the side, and then, by reheating, caused to collapse and unroll as flat sheets. With compressed-air blowers, a machine dips up a huge mass of the molten material, and rises into the air, blowing steadily until a shimmering, incandescent tube, forty feet or even more in length, rises like some great cathedral column.





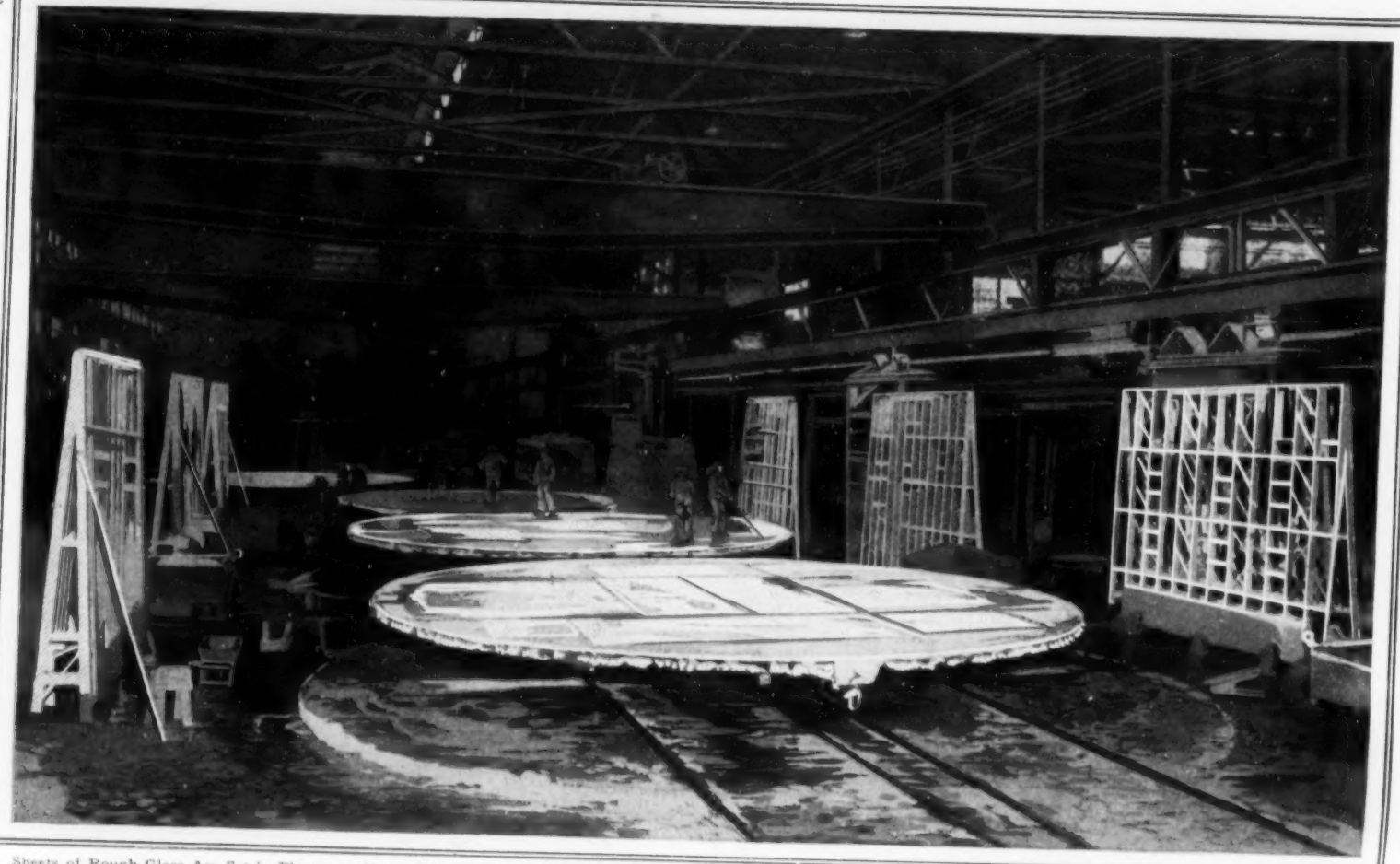


Plain Window-Glass Cylinders Are Split Open and Flattened after Being Cut in Short Lengths

Plate glass, on the other hand is poured from the melting pot onto a great metal table, then rolled to the required thickness by a huge steel roller, which spreads the heap of liquid smoothly over the table top. The sheet then passes into a long cooling chamber, where graduated gas flares keep it from losing heat so rapidly as to set up mechanical stresses and cause fractures from within. Emerging after a trip of 400 feet or more through this gradual process, the rough plate, which may be twice the thickness of the desired finished product, is bedded down in quick-setting plaster on a circular table, and wheeled under a battery of rapidly revolving grinding disks. Fed with abrasive sand, first coarse and then finer and finer, the disks wear the surface away, until a final polishing with rouge and felt disks gives a perfectly smooth surface.

The plate is then turned over and the process repeated on the other side, fol-

Huge Sheets, Polished on One Side, Are Stood on Edge While Workmen with Long-Handled Mops Wash Off the Plaster Which Held Them to the Surface of the Polishing Table, Using a Bath of Muriatic Acid to Remove the Adhering Coating Before the Sheets Go Back to the Polishers



Sheets of Rough Glass Are Set in Plaster on Huge Circular Tables and Then Tramped Down by the Feet of the Workmen to Force Out Air Bubbles; the Tables Are Pulled by Tractors to the Polishing Room, Where Revolving Disks Wear the Surface Down Until It Is Smooth

lowing which a washing with acid removes all traces of the plaster and leaves a finished plate, ready to go to the trimmers who cut out any flaws and reduce the rest to standard sizes.

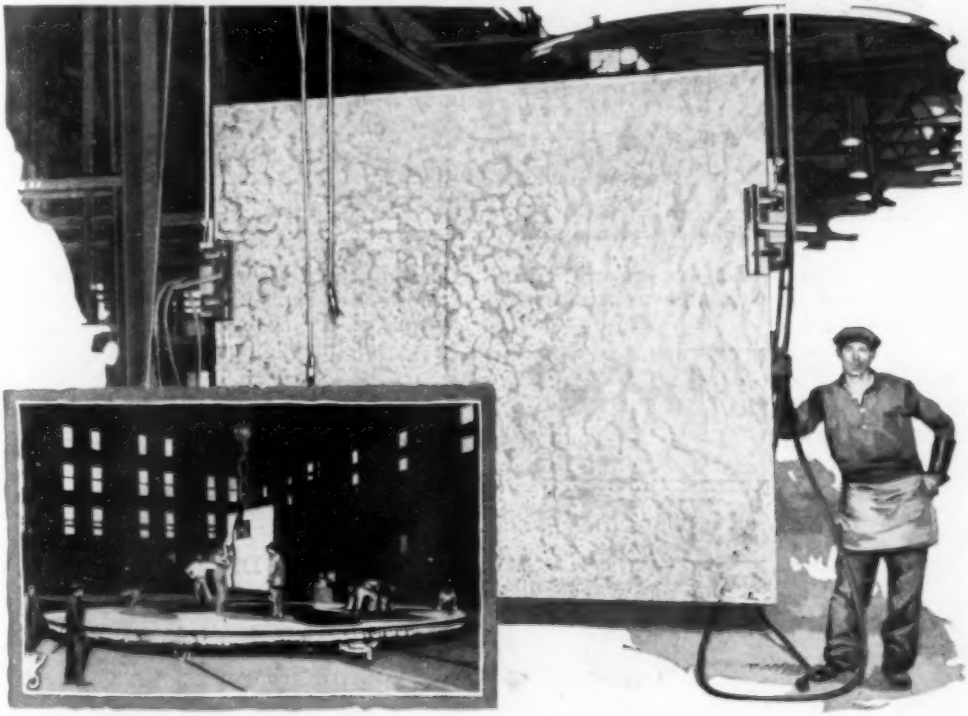
The difference between plate and common window glass is that the two surfaces of the former are absolutely parallel, and hence there is no distortion of light passing through it. Common window glass, on the other hand, gives distorted images and wavy lines, since its surfaces were created by blowing a cylinder which then was collapsed and spread flat by further heat.

The making of plate glass is a long and expensive process, not only because of the polishing it undergoes, but because the pot in which the material is melted must be so perfect as to withstand terrific heat. The clay for the pot is carefully chosen, left to lie in the yard for many months to season, and then is mixed with water and under the bare feet of the workmen, trod down until it is a perfect paste.

With small rolls of it, the pot builder starts work, building up the huge receptacle layer by layer, kneading and tamping each handful in place as he goes. The pot itself then requires weeks or months of further seasoning, and its life is often less than twenty days.

The demands of the automobile industry for vast amounts of plate glass for windshields and windows—since distortion of objects might prove fatal to the driver and his passengers—resulted in the invention of the almost wholly mechanical process, which replaces pots and other time-worn methods. Engineers declared it would be impossible to pour material into a furnace and have a continuous ribbon of glass emerge and travel down the cooling leer and polishing tables because the strain on a 400-foot ribbon of half-molten glass would be so great as to break it. The problem was finally solved, and in two plants the glass actually travels 442 feet without breakage or distortion.

The same plants that produce plate and common window glass likewise turn out many varieties of colored and special glasses. Metallic pigments added to the molten mass in the pot produce beautiful and brilliant colors without destroying the transparency of the material. The white tops of restaurant tables, and the black base and white sides of the soda fountain, which look like some rare marble, are nothing but glass.



Overhead Cranes Carry These Big Sheets of Rough Glass from the Pouring Tables to the Polishing Beds; Right, a Polished Sheet Ready to Have the Plaster Washed Off

Sheets of Rough Glass Are Set in Plaster on Huge Circular Tables and Then Tramped Down by the Feet of the Workmen to Force Out Air Bubbles; the Tables Are Pulled by Tractors to the Polishing Room, Where Revolving Disks Wear the Surface Down Until It Is Smooth

## CONCRETE CORN CRIB BREATHES PREVENTING LOSS OF GRAIN

Corn and other grains are kept from decay or destruction by animal pests in a concrete crib constructed of stavelike blocks, each having a steel-barred opening to permit ample ventilation. These vents, set in staggered fashion, occupy space equivalent to about twenty per cent of the wall surface of the crib. Air passes through them freely and at the same time, the bars exclude rats and mice. Steel bands surround the walls, to afford added strength and rigidity, and a chainless lift carries the grain to the bins.

This Concrete Corn Crib Has Openings in the Blocks to Allow Ventilation; Steel Bars in Openings Prevent Entrance of Rodents, and a Chainless Lift for the Grain Simplifies Filling

## MAGNET FUEL PUMP FOR AUTO INSURES CONSTANT SUPPLY

Vacuum, gravity and air-pressure fuel-supply installations in use on motor vehicles, may be replaced or supplemented by a small pump operated by the battery current and controlled by the ignition switch. It may be installed even by unskilled persons in the supply pipe at any convenient location except in proximity to exhaust pipes or manifolds, and performs by means of an energized spring, which makes about 5,000 strokes to pump a gallon of fuel. The gasoline delivery is controlled by the carburetor float valve.

Among the advantages claimed for this attachment, which already has been used with success on racing cars, is its ability to keep an even supply of gas flowing to the carburetor, regardless of grade, altitude, vibration or temperature. It also is said to prevent flooding the engine, reduce crankcase dilution, especially in mountain driving when the engine is used as a brake, and to automatically expose a faulty feed line, for if there is an air leak, the pump makes a peculiar noise as a warning. The regular capacity of a single unit is eight gallons an hour, but twelve gallons may be pumped in an emergency. More than one pump may be installed on larger engines.

## SUNFLOWER DIET FOR CATTLE

Sunflower seeds have developed into an important silage crop in Canada, where the seeds are used as cattle feed. Last year Alberta produced a sunflower crop of nearly 200,000 tons, the largest ever recorded. The seeds are declared to be the cheapest fodder crop ever harvested.

## TRIPLE FARM-LABOR CAPACITY WITH MODERN MACHINES

With the aid of modern machines, farmers are now able to till three times as much soil as they did seventy-five years ago, a government survey shows. It was not until within the last decade that the small gasoline tractor, auto truck and electric power came into agricultural importance. Farm and labor together account for approximately sixty per cent of the total cost of farming, and a better knowledge of the power requirements of farm operations and the adoption of more efficient types of power units will do much to cut down production costs, it is pointed out. Colleges are now studying how to increase the speed of farm tools by improving shapes and methods. One university has found that an ensilage cutter can be run at a saving of fifty per cent in power by use of proper speeds and an improved blower. Three billion dollars are expended yearly for animal and mechanical power for American farms and the total power used reaches about 16,000,000,000 horsepower-hours.

## AUTO AS STARTER FOR PLANES SAVES HAND LABOR

When airplane motors "stall" on an English flying field, a small automobile fitted with a cranking attachment speeds to the ship, giving the propeller the turns that generally start the engine. The propeller shaft is actuated by a chain gear driven by the motor of the auto. This is quickly adjusted to the plane by means of an extension clutch and not only saves the difficult and sometimes dangerous work of starting the blade by hand but shortens delays.

## TAIL LAMP FOR SADDLE HORSES PROPOSED FOR SAFETY

When the suggestion was made in Chicago that saddle horses be equipped with

Rider Wearing Battery Lamp as Tail Light for Horse

tail lights for safety on the park bridle paths after dark, the question arose as to how the lamp could be attached. An eastern inventor proposed as the simplest solution that the rider might carry a battery and a bulb in a small box strapped across the chest and arranged to rest close to the horse just back of the saddle. A glass-covered compartment holds the light so that it will be in plain view of riders or vehicles approaching from the rear.

Preparing to Start an Airplane Motor with Cranking Arm on Light Auto; Shaft Is Turned by Chain Drive Geared to Engine and Is Regulated by Driver

# Still Unchanged in a Changing World

Left, Bullock Cart with Its Slow but Certain Steed, Serves as a Thirteen-Passenger "Roadster" When Children in India Want a Pleasure Ride

—o—

Below, the Donkey Helps Take a Family of Albanian Turks for an Outing; True to the Custom of the Harem, the Woman Keeps Her Face Covered When Abroad

© Keystone

Many Trappers in Alaska and Other Far Northern Fields, Find the Reindeer Teams and Sleds Ideal for Travel over the Snows as They Are Faster than Dogs

© Keystone

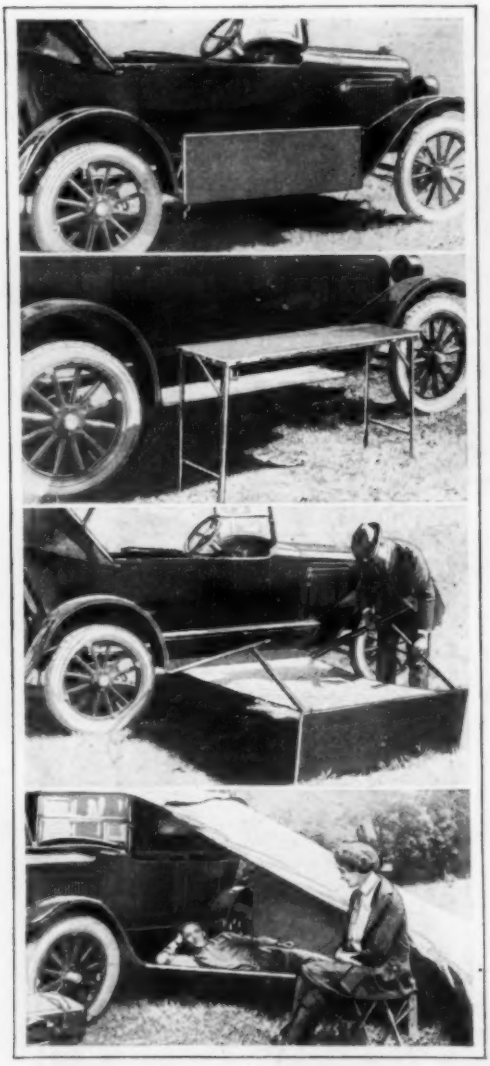
Though Albania Is Progressing in Many Other Lines, Many Natives Cling to the Domestic Buffalo as a Source of Motive Power; the Beasts Are Slow but Strong and Steady, and the Driver Controls His Team with His Voice and a Short, Sharp Stick

# Joy Riders at the Outposts of Civilization

When Indian Princes Travel, the Splendor of Their Elephant Cars Attracts Wide Attention; Gaudy Trappings Cover the Beasts, Their Tusks Are Decorated by Artists, and the Whole Turnout Sparkles with Its Rich Display of Wealth; Left, a Ceylon Messenger Boy with a Load That's All in the Day's Work, for They Can Easily Carry Packages Twice Their Own Weight

The Ornate Zulu's Rickshaw at Right Is for Europeans Only; Below, a Camel Train in South Australia Hauling a Load of Wheat to the North

Circle Insert © Burton Holmes



From Top to Bottom, Outfit Used as Luggage Carrier, Table, Bed and Tent Support

## AUTO CAMP OUTFIT COMBINES FOUR ARTICLES IN ONE

Luggage carrier, double bed, table and a couch that may be used away from the car are combined in a convenient unit that fits the auto running board, is easily set up and taken apart, and is strongly constructed. As a baggage rack, the attachment is clamped to the board, the sidepiece of sheet steel being high enough to form a deep pocket for the luggage and strong enough to support heavy loads. This piece becomes one end of the bed when the carrier is pulled out and is also the table top. It is large enough for serving six persons. Angle-iron legs, with clamp hooks for holding kettles, support it. By driving stakes in the ground and clamping the bed to them, the canvas strip that serves as a mattress and its row of coiled springs at one end, can be used independently of the car. The outfit is also used as a tent support.

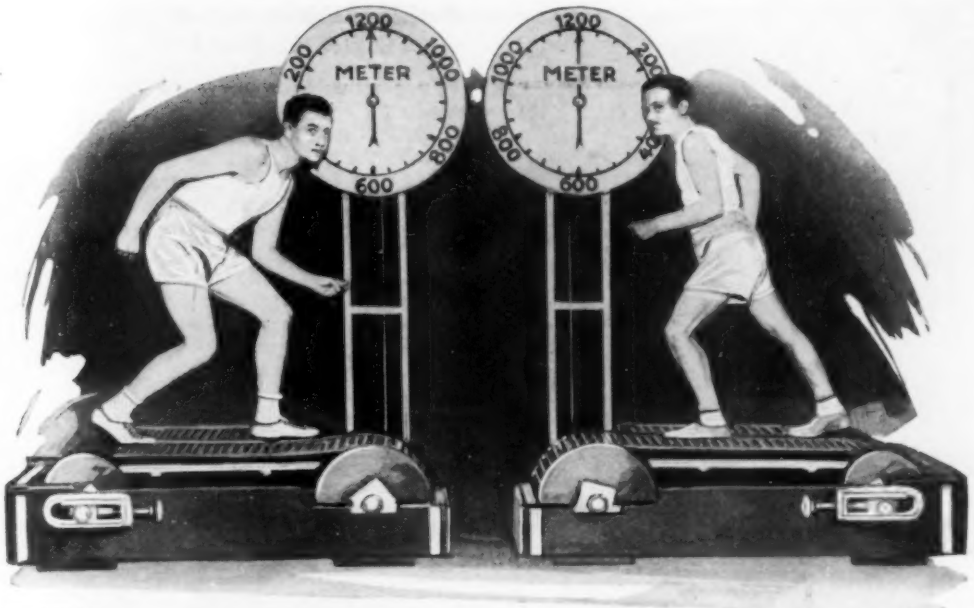
## WOMEN IN INDUSTRY INCREASE

Twenty-three out of every 100 women and girls over fifteen years old are employed in gainful occupations, according to an analysis of census figures by the women's bureau of the department of labor. The number increased from 3,750,000 in 1890 to 8,250,000 in 1920, the greatest gain being shown in "typical city industry," such as factories, trade and clerical occupations. Wages and working hours are not yet on a par with those of men in the same fields, according to the report, which also shows that the majority of women in a number of states work more than forty-eight hours a week. Ten of the thirteen states included in the bureau's survey allowed more than one-half of the working women to labor longer than eight hours a day.

## CLIPS FASTENED TO SHOE TOPS KEEP RUBBERS ON

With a simple and quickly adjusted gripping device now on the market, rubber galoshes can be held securely on in spite of mud or loose fits. It consists of a metal hook that slips over the top of the shoe at the rear and holds a spring-jaw gripper which is fastened directly to the rubber. There is a tape connection between the two metal parts that may be taken up to insure a tight hold when wear on the rubber shortens the distance. The attachment is inconspicuous and saves the unpleasant task of adjusting muddy rubbers while walking.

¶Names and addresses of manufacturers of articles described in this magazine will be furnished free by our Bureau of Information.



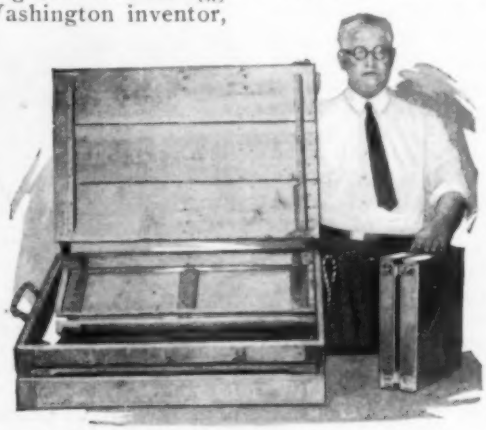

© Keystone
Treadmill Walkers Performing for Circus Crowds; Distance Is Ticked Off on Big Dials Geared to Rollers

## WALKING RACE ON TREADMILLS ADDS TO CIRCUS THRILLS

Long-distance walking competitions on treadmills, geared to meters which show how far the contestants have gone, furnish spectators at a circus in Berlin a novel diversion from the usual entertainment features. The dials can be seen plainly, and the arrows give the relative "position" of the performers.

## FOLDING BOX FIVE YEARS OLD STILL IN SERVICE

A collapsible packing box and an egg crate devised by a Washington inventor, have been in service five years and are said to be still in good condition. The larger container, extended, has a depth of seventeen inches, but folds to a height of six and one-fourth inches, while the crate, a foot deep when adjusted for filling, collapses to a depth of four inches. Besides saving valuable shipping space, boxes such as these have proved an important factor in conservation of lumber.



Packing Box and Crate Used for Five Years

## GIRLS TAUGHT ELECTRIC TERMS TO AID HOUSEWORK

Domestic-science teachers are training their girl and women students in the simpler electrical terms in order to help them to understand what they buy when they order a new instrument for the home, and what the cost of power will be. When the installation man tells you that the new range will cost three cents a kilowatt-hour for your cooking, he means that electrical units are called "watts" and "kilowatt" means a thousand of them. "Voltage" means the force required to send electricity into the kitchen and is as important to know as the watts. Quantity of electricity is expressed in "amperes," the flow through the wires being expressed as so many amperes a second, just as one describes the water flow as so many gallons a minute.

Spring Motor Concealed in Bag Cranks Small Motion-Picture Camera through Flexible Shaft

## MOVIE CAMERA IS CRANKED BY MOTOR IN BAG

Cranked by a small spring motor held in a bag slung from the operator's shoulder, a new motion-picture camera is almost small enough to be called pocket size. A flexible driveshaft allows use of the machine at almost any angle. Due to the light weight and a handle like that of a saw, there is no need for a tripod, the camera being rested on one palm and steadied with the other hand.

## THE WORLD'S BIRD POPULATION

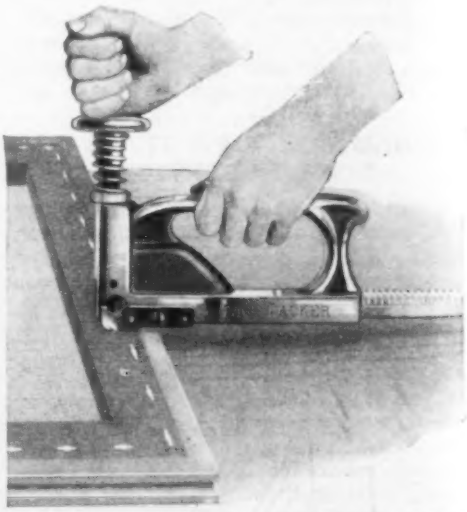
Statistics gathered by the department of agriculture indicate that the total bird population of the world is approximately 75,000,000,000 or about forty times the number of human beings. Records showed that there are an average of approximately 224 birds for every hundred acres of land. On this basis, the bureau of biological survey estimated that in the northeastern and central states of America, there are 82,660,089 robins, 69,300,883 English sparrows, 50,514,499 song sparrows, 33,815,491 catbirds and 22,126,185 bluebirds. Nine species in all, made a total of 364,455,847, while the other kinds swelled this figure to 1,052,722,161, the estimated number for that part of the United States, or about a fifth of the whole bird population for this country.

## TOLL BRIDGE SIX MILES LONG TO CROSS FLORIDA BAY

To connect the sides of Apalachicola bay in northwestern Florida, an auto toll bridge, six miles long, has been authorized and should be completed in 1928, according to the terms of the franchise. The structure, which is estimated to cost about $2,000,000, will be an important link in the Gulf coast highway from Pensacola to Tallahassee, officials declare, as it will greatly reduce the distance and running time between the cities and open up a region of scenic beauty. It has been proposed informally to name the bridge after Dr. John Gorrie, inventor of an artificial-ice machine. A marble statue of the inventor already has been placed in Washington by the state of Florida.

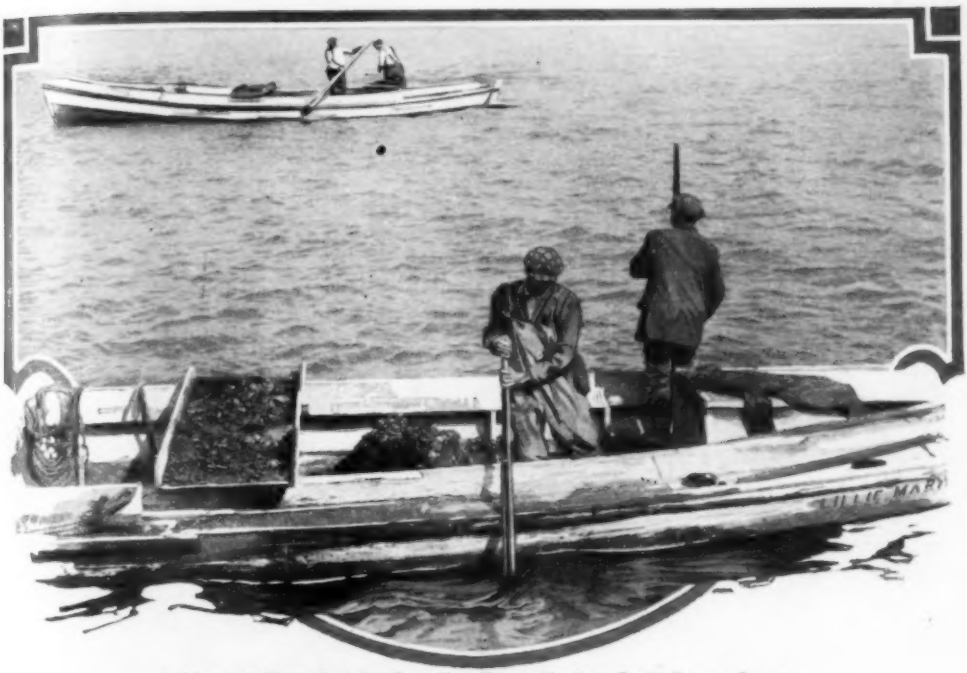
## TOOL TACKS AND STRETCHES SCREENS QUICKLY

Screen cloth is attached to the frames and stretched at the same time by a combination tool provided with removable steel claws for drawing the mesh into position for the insertion of a staple which is driven in by a plunger. When it is desired to use the implement on plain work, the claws may be taken off. The tacker holds a magazine consisting of seventy-seven staples joined together in one strip,



Screen Stapler and Stretcher in Operation; the Teeth That Grip and Mesh Are under the Plunger

preventing waste and saving time in reloading. The outfit weighs less than two pounds, may be carried in the hip pocket and will withstand heavy usage.



Lifting and Emptying the Grappling Tongs Used to Catch Parent Oysters

# Hatching Oysters in Incubators

BY devising a way to propagate shellfish, science probably has saved the oyster from extinction. Due to the march of modern industry and the serious inroads of natural enemies, oyster culture, the most valuable fishery on the Atlantic seaboard, with an output estimated at $16,000,000 and providing employment to 65,000 people, has been falling off.

During the summer months the mother oyster lays its eggs. Nature has provided each one with 16,000,000 eggs. Of that number, however, not more than a few hundred survive under the best conditions, and only one out of the entire lot lives long enough to reach the consumer's table.

The eggs grow into tiny, clamlike forms provided with a propeller with which they swim around. Within perhaps fifteen days they cease swimming and "set," that is, they attach themselves to some hard clean surface such as a rock or a post. Then they have nothing more to do except to breathe, eat and grow. Those that fall upon a soft muddy bottom are smothered. The infant oyster, so tiny that the human eye cannot see it without the aid of a powerful microscope, faces a continual battle for life. Larger organisms feed on it, and it must struggle with tides, waves and winds, which carry myriads of them out to sea.

It was an American scientist, Prof. W. K. Brooks, of Johns Hopkins university, who discovered that artificial propagation of the oyster was possible. He was followed by William F. Wells, of New York, who, for an entire year, lived on a lonely fishermen's island with oysters for company. Thus he learned their habits and hit upon a means of prolonging their existence.

At the oyster hatchery that serves as a laboratory for Mr. Wells, the oyster eggs are gathered and placed in glass jars with clarified water. After being fertilized, they rise to the surface, when it becomes easy to siphon them off into large stone crocks. Later they are placed in a device like a cream separator which revolves 7,000 times a minute. After several minutes, the tiny oysters that have clung to the sides of the revolving bowl are removed through rinsing. It is necessary to take the word of the expert that there are oysters in the water, however, for to the naked eye, not even the smallest speck is visible. According to Mr. Wells, hundreds of thousands of these baby oysters, if not a million, could be contained in a tablespoon of water.

Mop of Twisted Rope Yarn to Snare the Starfish That Destroy Oysters; When Caught, They Are Killed in Vats of Boiling Water

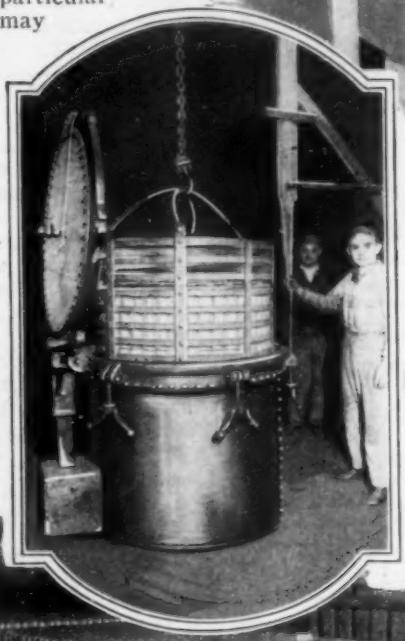
On Board an Oyster Boat, Showing Hand Dredge and Winch in Operation; Sailing Craft Still Serve the Fishermen along the Atlantic Coast

As in Other Kinds of Fishing, the Motorboat Is Coming into Prominence to Help in Gathering the Annual Sixteen-Million-Dollar Oyster Catch

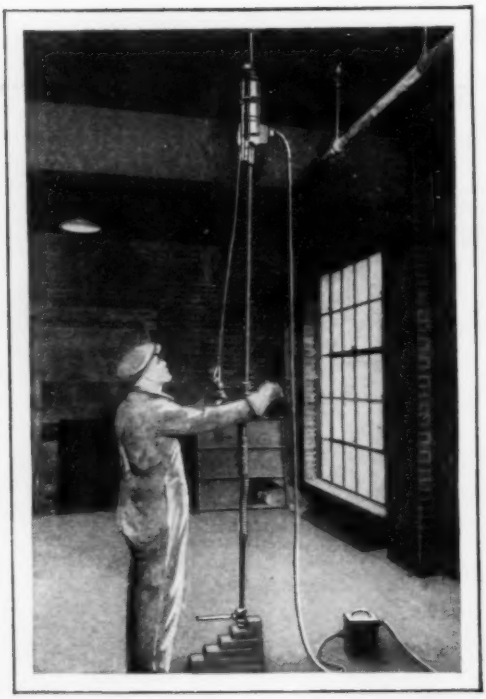
This is only the first step of the oyster's long journey to the consumer. In about four weeks the oysters are old enough to set. They then will attach themselves to a surface on which they can stay and begin to grow. So, early each summer the oyster planter tows large scowloads of old shells to sea and then scatters them in a level layer where the young oysters may be allowed to grow to adult size, which requires about four years in New England waters and two years in the warm waters of the Gulf of Mexico.

The "oyster farmer" leases his "grounds" from the particular state on which they may abut. The fisherman who wishes to plant shells or seed pays a rental of from one to ten dollars per acre a year, or a tax. Stakes or buoys mark the boundary lines of each farm, and state police boats patrol the waters to protect the fields from being molested or robbed.

After the oyster grower has put down the shells and secured a good set of young oysters, he often finds that he has but offered a new haven for various kinds of worthless, hungry loafers of the sea, which fall upon the oysters and devour them in great numbers. Fully ninety-nine per cent of the oysters produced in the United States are harvested on the Atlantic coast.



Steps in the Oyster's Journey from Sea to Stew; Above, Washing Fresh Meats on Skimming Board; Center, Basket of Canned Oysters Ready for Steaming, and Below, Labeling and Boxing Cans



Boring Hole in Concrete Ceiling with Overhead Electric Drill on Telescoping-Tube Support

## CEILING DRILL FOR CONCRETE SAVES TIME AND WORK

How to drill holes economically in concrete is one of the problems that this form of construction has created. As a solution, an electric drill now on the market, bores openings overhead while the operator stands on the floor below. The tool is held in place by means of adjustable telescoping pieces of steel tubing and handles are provided at a convenient working height so that the operator can turn the drill. A coil spring below the telescoping joints provides the necessary pressure to make the bit take hold. The motor is controlled from below.

## MELT AUTO TIRES FOR ROADS OF RUBBER IN ENGLAND

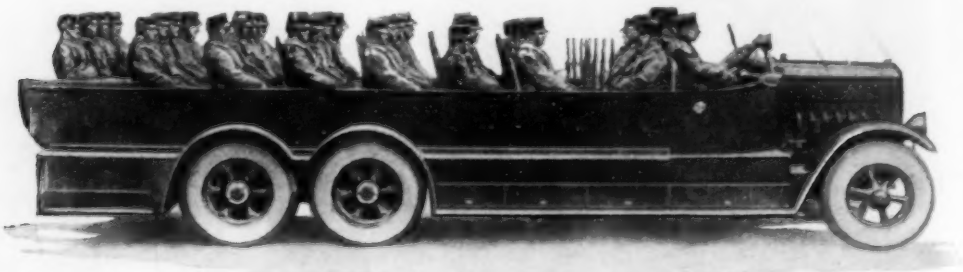
Discarded auto truck tires, shredded and melted, are being used to make rubber roads in Bradford, England. Blocks cut from the tires were tried first but it was found difficult to keep them in place. Then it was decided to melt the tires, after cutting them to bits. A secret solvent is added to the bits of rubber and the whole is oiled. Then it is poured, nearly three inches thick, over the concrete surface. Wooden trowels, coated with clay to prevent sticking, press the material flat and then it is smoothed with a heavy hot roller. It is said the cost of the material is offset by money obtained from the sale of steel bands inside the tires.

## HOT AIR AS A POLISHER

Just as sand blast is used to smooth and polish various surfaces, a current of hot air, applied with tremendous velocity, gives metal a brilliant luster. Articles to be treated are placed in a basket in a centrifugal apparatus that whirls them at high speed. As they turn, a blast of heated air is blown in through a pipe. A high polish is said to be obtained in a few moments. Nickelplated objects which have become tarnished are made bright in little time. The only precaution necessary is to pack the articles in the basket so that the air will strike them on all sides.

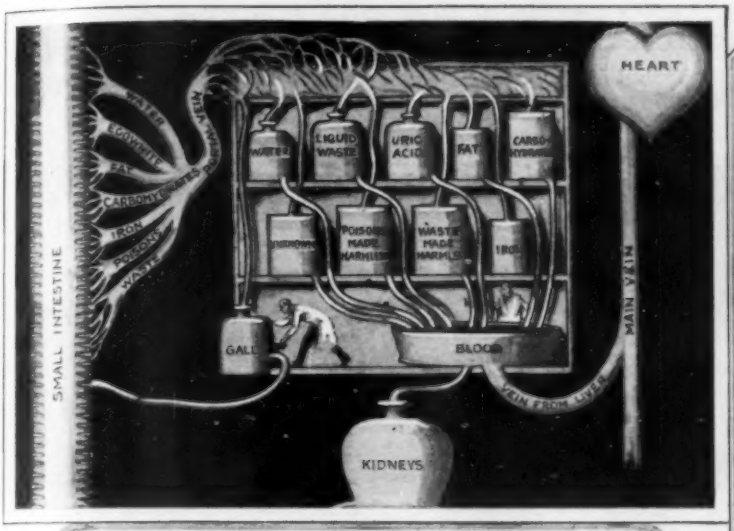
## SIX-WHEELED BUS FOR RIOTS HOLDS THIRTY-TWO MEN

When riots occur in Dresden, Germany, a six-wheeled motor bus, seating thirty-two policemen, is driven to the scene. The vehicle has balloon tires and a four-wheel drive, and is said to be capable of great speed. The police are trained to enter and leave the bus in military order to save time and confusion.



Six-Wheeled Motor Riot Car for Service in Germany, Loaded with Thirty-Two Policemen besides the Driver; Seats Hold Four Each, Preserving Military Order While Traveling

# The World's Most Wonderful Power Plant



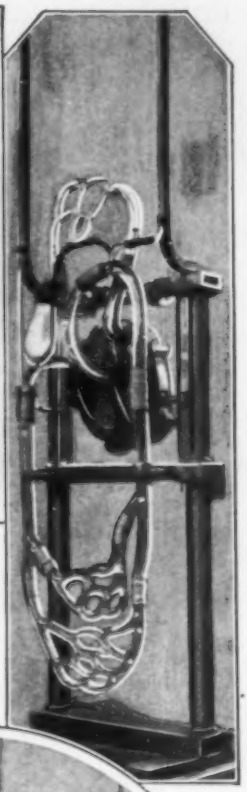



Diagram of Human Liver, the Chemical Laboratory Which Changes Foodstuffs into Substances Usable in Nature's Marvelous Plant, Showing Products and Disposal; Right, Model of Circulatory System Which Forces Red Liquid through Tubes Just As Heart Sends Out Blood

Every Half Hour, the Heart Pumps Enough Blood to Fill the Huge Glass Container Above; at Left, Is an Exhibit Illustrating the Amount of Food Consumed by Average Person in One Year

## COMBINED DRILL AND LATHE HELPS RADIO BUILDER

For the fan who likes to build his own radio sets, a combination hand drill and lathe that clamps to the workbench,

Tool in Use as Lathe and as Hand Drill

has many uses and is so compact that it will fit in almost any tool kit or can easily be carried. As a drill, it is high enough for working on large cylinders for coils and deep enough to drill panels for radio sets. It is fitted with two screw-feed wheels, one for feeding and quick return and the other for sensitive drilling. By shifting another screw, the drill is turned to a horizontal position where it can be locked and used as a hand lathe for light turning, grinding, coil winding, filing and fitting parts, and many other purposes. If desired, the drill may be tipped at an angle for special work, or the frame may be detached from the base, and with suitable handles, which are provided, may be used as a portable drilling outfit for repairing automobile fenders, boring holes in walls or partitions, or other tasks where a hand or breast drill is needed.

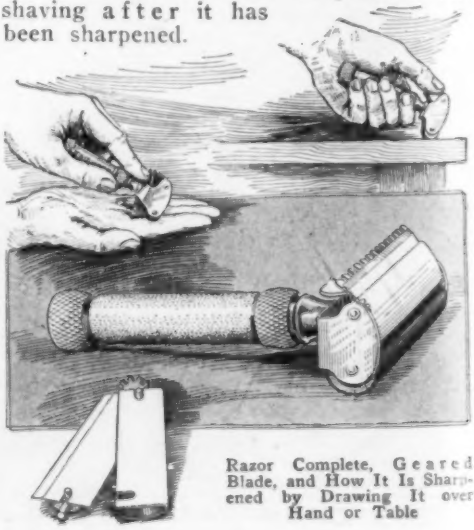
¶It costs approximately $40,000 to operate the steamer "Majestic" on a single round trip between Southampton and New York. The vessel consumes about 11,000 tons of oil in the 6,400 miles.

## STEERING POST REGISTRY CARD HELPS OBEY AUTO LAW

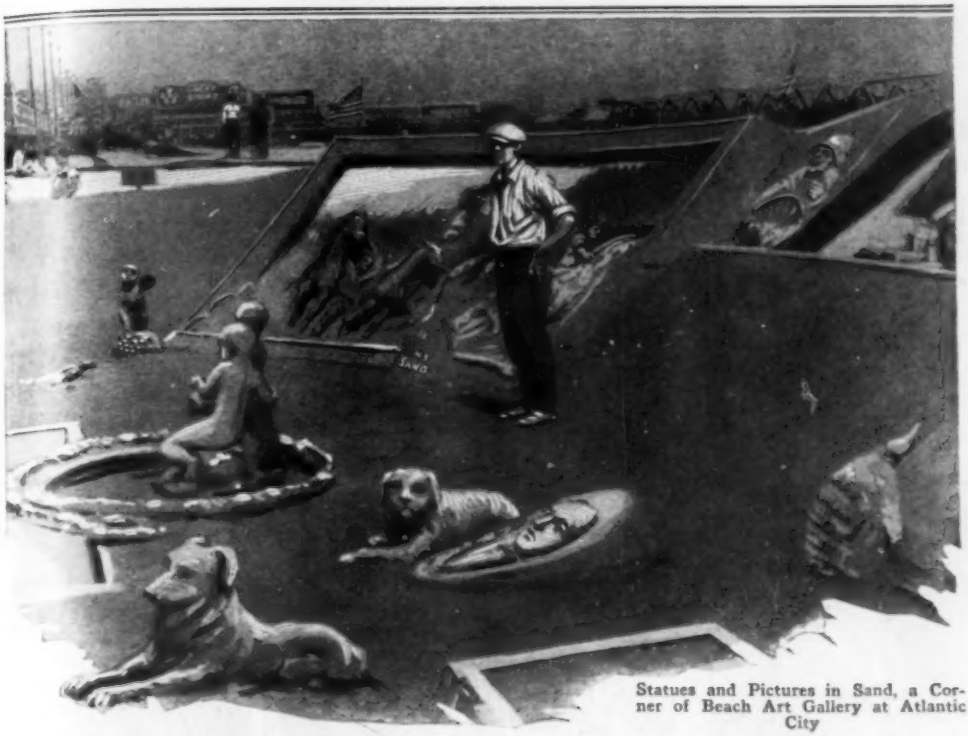
To help comply with a law in many states that the auto-registration card must be in sight at all times, often impossible when a closed car is locked and the card is under the dash, a holder for fastening it to the steering post, under the wheel, has been put on the market. An aluminum frame in which the card is placed, under a celluloid sheet, is bent around the post, then tied with a strip of aluminum whose ends are bolted together. The inquiring policeman may see the card through the windshield, if need be.

## SELF-SHARPENING SAFETY RAZOR

Simply by rolling it over the hand or a table, a safety razor now on the market, is said to be sharpened quickly and thoroughly. Back of the cutting edge is a small stropping roller, or hone, fixed to a shaft which is geared to the blade holder in such a way that the blade is reversed with each change of direction and the amount of pressure of the blade against the roller is regulated. A latch at the base of the handle locks the blade in position for shaving after it has been sharpened.



Razor Complete, Geared Blade, and How It Is Sharpened by Drawing It over Hand or Table



Statues and Pictures in Sand, a Corner of Beach Art Gallery at Atlantic City

## ART GALLERY MODELED IN SAND IS NOVELTY AT BEACH

What skill and patience can do with as simple a medium as sand was illustrated in the art gallery fashioned on the beach at Atlantic City. Reproductions of famous paintings were molded in relief with a "frame" of sand about them, statues, masks, figures of animals and bas-reliefs of wide variety being included in the collection, which was displayed in the open.

## QUEER HARPS MADE TO ANSWER NEEDS OF MODERN MUSIC

Demands of the jazz era for novelty in music have brought forth two new instruments to add to thousands invented since the first drum—a hollow tree—was beaten by a shinbone. These are the "mandolin-arpa," a miniature harp arising from the neck of a mandolin with scroll-like edges, and the "swinging harp," now being played for the radio. The latter is said to have a liquid tone resembling chimes. Odd devices are not limited to modern days. Cuckoo clocks long ago were used in opera, and one composer wrote a part for a sewing machine. Grotesque fiddles and pianos were in demand during the last century, and Handel is said to have expressed a desire to introduce a cannon report in one of his scores. The present-day zenith was reached recently in a New York concert in Carnegie hall when a pistol shot was used to emphasize a bit of jazz. A machinist makes a good salary playing a handsaw on the stage.

## SWIVEL-END SOLDERING IRON REACHES DIFFICULT PLACES

Soldering in difficult places is simplified with an electric iron, supplied with current from a wall socket, that has a swivel point adjustable to any angle up to forty-five degrees. It is said to be well adapted for use in building radio sets, has a heating element that has been constructed to resist burning out, and is also equipped with a straight point with two interchangeable threaded tips.

Iron with Swivel Point That Simplifies Soldering in Corners and Other Spots Hard to Reach

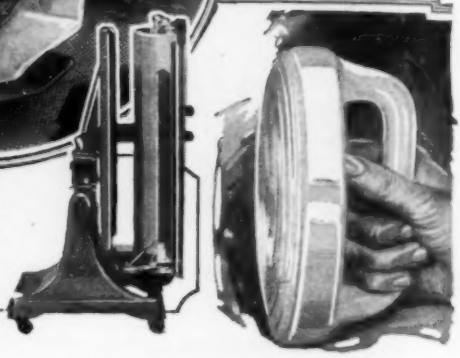
# Time and Money-Saving Tools

Spring-Wire Egg Holder Curves Inward to Afford Firm Grip, Permits Easy Insertion and Has Feet at the Bottom for Stability

© C.A. Oldroyd

Darning Ball of Rubber Will Not Break or Dull the Needle and Prevents Injury to the Fingers Besides Being Easy to Handle

Electric Ironer Does Quick and Accurate Work and Folds Up Out of the Way When Not in Use



Combination Window Lock and Bell Burglar Alarm Is Easily Fitted to the Sash by Means of Gripping Jaws

White-Enamel Griddle Greaser with Removable Wick

Bottom for Kettles to Prevent Burning Is Adjustable to Different Sizes

Right, Two Tables in One from This Article with Adjustable Top Give Space for Eight Diners

Left, Electric Candlestick Lights Up Only When Lifted



Anyone wishing further information on devices described in the editorial pages can

# for Woman's Workshop in Home

Little Disk Inserted Before Paraffin Is Poured on Jelly Aids in Removing the Covering and Does Not Disturb Contents of Glass

These Curtain Rings Roll on Top of the Rod, Are Quickly Adjusted Like Spring Clamps, and Prevent Wear on Hangings

© C. A. Oldroyd

Food Grater with Sanitary Glass-Topped Hopper Prevents Injury to Fingers and Keeps Material Pressed against Blades, Saving Time and Labor

Rubber Sleeve Protector Is Quickly Slipped On and Can Be Washed with Hot Water and Soap

Handy Scourer Cleans and Sharpens Knives at the Same Time

Right, Easily Operated Can Opener Removes Tops from Square as Well as Round or Oval Containers by Turning the Finger Screw

This Compact, Lightweight Electric Range Has No Legs, But Is Supported on a Wall Bracket

Wire Holder for the Paintbrushes Helps Keep Handles and Bristles in Good Condition

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

Gates Opening as Release Is Unlocked at Entrance to Grounds, and View of Motor Mechanism Showing How It Is Geared to the Gate Support

## DOORS ARE OPENED AND CLOSED BY ELECTRIC MOTOR

Greater security and convenience are sought in opening and closing heavy steel doors in banks and big gates at entrances to public or private grounds through an electric installation now on the market. For driveway gates, contact of a master key in a lock switch completes a circuit through a mechanism geared to the gates and set in a pit where it is protected from water. The barriers close when an auto or other vehicle passes over blades that project from the roadway. If desired, a telephone may be installed outside the grounds near the entrance by which guests can announce themselves and receive admission when the switch at the house is turned. The gates open automatically to outgoing vehicles by means of a trigger arrangement set in the drive.

## CONQUER GREAT ODDS ON TRIP TO TOP OF MT. LOGAN

Fighting their way back to civilization through 150 miles of virgin territory, a third of which was traversed with the aid of ropes, a party of six adventurers has returned after gaining the summit of Alaska's Everest, Mt. Logan, 19,580 feet above sea level. Because of its formidable natural barriers, the peak has been considered second only to the Himalayan mountain in point of danger and difficulty. Months were devoted to preparation for the exploit. One member of the group was forced to descend after he had climbed to a height of 19,000 feet because of painful frostbites, but otherwise there were no accidents. Bad weather followed the party on the return trip from the Yukon. Twenty days were required for the homeward journey which led over broken ice and swollen rivers.

## LAWN-EDGING TOOL TRIMS SOD WITH UNIFORM GROOVE

To give lawns a spick and span appearance along the walks, an easily operated edger has been devised. It slices the sod with a simple pulling motion, reaches into corners and gives a groove of uniform width and depth. No stooping is necessary.

## USEFUL INVENTIONS BY WOMEN LIGHTEN HOUSEHOLD TASKS

Patent-office records both in this country and in England show that women's activities as inventors are increasing and that many of their ideas are directed particularly to better ways of doing things about the home. According to reports from London, two women there are mak-

ing a business of inventing and placing their patents on the market. Among the household aids which women have devised are a combination cake knife and server. It is an attachment that may be placed on any knife so that slices of bread or cake can be transferred to a plate without touching the fingers. A workbasket that has a celluloid ring around the top on which are threaded reels of silk and cotton and to which scissors, tape measure and other accessories are attached by hooks, is a woman's solution of the usual tendency of the sewing materials to get into disorder. A folding-lattice drier, secured with rustless nails, may be placed across the top of the clothes horse or between two chairs to support articles of clothing that must be laid flat when drying. This also is a woman's invention and was constructed so that it could be collapsed into small space when not in use. A combination bed and table with a spring mattress concealed underneath an oak top is another device patented by a woman.

## DASHBOARD MAP ON ROLLER USED WITH ONE HAND

An auto map that can be used with one hand and interferes with steering but little, is attached to a spring roller screwed into the dashboard beneath the instruments. Replacing hand maps, which usually mean stopping the car and having the wind whip and tear the paper, the new chart is framed on two ends, giving it rigidity. To inspect, the driver simply pulls out the roll. The spring returns it to position out of sight, when reading is done. Entering another state, a new map may be inserted readily.

Roller Map Spreads Out Flat for Convenient Reference and Requires Only One Hand

## COWBOYS GAINING IN NUMBER BECAUSE OF RODEO NEEDS

Rodeos, or round-ups, for which skilled riders are needed, and the demand for them in motion pictures have resulted in an increase in the past few years in the number of cowboys in the United States. During 1925, it is estimated, there were more than 100 round-ups to which the public paid admission. One band of trouping ranch riders even went to Europe and played before the crowned heads and their subjects. The western boy or girl who learns to ride anything on four legs can be fairly certain of well-paid work, even though on the ranches the man with flapping chaps and drooping sombrero is being replaced by a hired helper with blue overalls and dingy felt hat. "Outlaw" horses, so-called, are also much in demand of late. Owners value them at $1,200 to $1,500 and more, but rent instead of selling them. Steer-riding events are popular with the public. Brahma cattle, a wild crossbreed of gentle East Indian beasts and ferocious Mexican animals, are found best for this purpose.

Cowgirl Demonstrating Her Skill as Rider on Plunging Steer during Competition at a Western Rodeo

## MOTOR-DRIVEN TRACK SHIFTER SAVES TIME AND LABOR

Easily operated by only one man, a track shifter propelled by a forty-horsepower gasoline motor is said to do the work of a crew of twelve or more men, and in a fraction of the time. It consists of a powerful lifting apparatus mounted on a truck which can attain a speed of twenty-five miles an hour in going to and from jobs and has space for carrying extra men and equipment. In operation, a spud or foot is lowered to the ground at a point off center between the ties and set at such an angle that when upward force is exerted, the track, which is clamped to the truck, is lifted to one side. The shifter is then moved a few feet ahead and the process repeated until the whole section has been shoved to the desired position. When necessary, the track may be raised directly upward simply by placing the spud midway between the rails. The outfit is intended to reduce traffic delays, save time and cost on construction jobs, and is said to operate successfully even when the ties are frozen to the ground without danger of kinking the rails or bending the tie plates.

Track Lifter in Operation; Spud Is Set between Rails, and Truck, Clamped to Them, Is Elevated upon It

## MEMORIAL PLANNED FOR HUSKY THAT BORE SERUM TO NOME

Dog lovers of New York city are planning to erect a memorial to "Balto," the husky that played a leading part in carrying serum to fever-stricken Nome, Alaska. The monument will show the tense figure of a dog straining to reach a goal against great odds. "Balto's" deed recalls other canine heroes and the remarkable feats they accomplished. Among the most famous of St. Bernard dogs was "Barry," who saved forty persons during his ten years of service among Alpine snows. One of the dog's most notable feats was the rescue of a ten-year-old child whom he found in the fatal sleep that precedes death by freezing. "Barry," according to the story told by a monk of the hospice, warmed the victim by his breath, finally made the boy climb on his back and so carried him to safety. A monument has been erected to the memory of "Barry." Another dog hero was "Bob," a Newfoundland, made a member of the humane society of England and recipient of two medals of honor. When only one year old, "Bob" saved his master from drowning after a shipwreck, and in later years rescued several other persons from similar death and from fire.

## DETACHABLE GOLF CLUB GRIP IMPROVES THE STROKE

Easily slipped on the handle of the golf club, a slightly protruding circular grip is said to improve the stroke by permitting greater relaxation of the hands. It acts as a guard to keep the club from slipping so that the player does not have to clench his fingers so tightly, allowing greater freedom both on long and close shots.

Grip Ring Detached and on Club in Position to Prevent Slipping of Hand

# Who Smokes More—You or Your Fireplace?

By ROBERT TAYLOR JONES

EVERYBODY knows that the place for the smoke from a fireplace is the chimney, and everybody knows also that it does not always go there.

This is a problem seriously interesting to you, if you are going to build a home. Let us see what makes the smoke come out into the room rather than go up the flue where it belongs.

First let us think of a fireplace as a kind of a masonry cavern made fireproof so that a fire can be built there with impunity. Now if you run the flue straight up through the roof so that there is no obstruction anywhere, the smoke certainly ought to go up without any question. But, just a minute; suppose the fireplace is only six inches deep; then the fire itself must come at least to the face of this masonry cavern, and the smoke would just as easily go out into the room as up the flue. If the fireplace arch is very high with this shallow depth, perhaps all of the smoke would miss the flue. On the other hand, let us suppose that the fireplace is three or four feet in depth and the arch very low. There would then be no question that all the smoke would go up the flue. Quite evidently the depth and the height of the fireplace have something to do with this matter of final direction of the smoke.

We can state two very simple rules in this connection. First, the minimum open depth of any fireplace from front to back is twenty-one inches. Second, the depth of the fireplace with a masonry throat must be at least two-thirds as great as the height of the fireplace opening. There you have a very definite way to associate proper sizes for the fireplace. As you raise the height of

## Do You Realize

THAT wind velocity has as great an effect on house heating as does temperature.

That, roughly speaking, one mile of additional wind velocity per hour has the same effect as one degree lower temperature.

That weather strips on windows and doors will prevent losses due to the necessary cracks around these openings.

That construction at the eaves and in attic spaces can be easily and cheaply improved to prevent wind losses.

That smaller fuel bills and smaller heating plants will pay for the slight additional costs of construction.

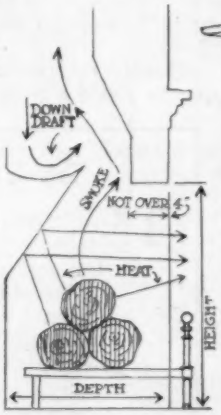
Here Is a Fireplace That Does Not Smoke, and Below Is the Reason Why, Plenty of Depth and Proper Down and Up Drafts; the Fireplace at the Right Smokes Because It Is Not Deep Enough

the opening, you must increase the depth of the hearth. If you have a fireplace large enough to walk into, six feet or more in height, you would require a minimum depth of four feet. If the height is thirty-six inches, then the depth should be at least twenty-four inches. A most excellent rule.

The second consideration is the connection between the fireplace and the flue. If we run the fireplace directly into the flue without the least obstruction, and if all the details are handled properly, all the smoke will go up. But all the heat will go up also. The problem is to get all the smoke out and reflect some of the heat back where you are sitting.

We call the connection between the flue and the fireplace the throat. We baffle the smoke by means of this throat. Some of the heat must go with the smoke to help the smoke rise—to increase the draft. Some of it must be radiated out—therefore the oblique surface opposite the baffle.

Further, this oblique surface, which we may call the roof, ought to go high enough so that the smoke will be thrown against the front arch of the fireplace. You can see how important this is, for if the roof is set at a lower level, the smoke quite certainly will be thrown underneath



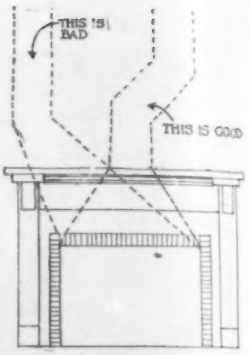

the front arch, and some of it will surely find its way into the room. The space between the roof of the fireplace and the front arch must be so wide that it lets out all the smoke, yet narrow enough to hold some of the heat in. What is the proper dimension? Happily we have another rule to guide us here. It is this. There must be at least sufficient horizontal area in this restricted place, called the throat, to equal one-tenth the area in the front of the fireplace. Thus, if the fireplace is three feet high and four feet wide, you have twelve square feet. One-tenth of this is 1.2 square feet or 172 square inches. If the throat is made as wide as the fireplace, as it should be, and the fireplace is four feet wide, you

Be Sure Your Flue Goes High Enough to Create a Draft, and Remember the Bricks Dropped Down the Inside by a Slovenly Workman Are Worse Than Useless

must have a little over three and one-half inches for the depth of the throat to get the required area. Let me say again that this is the minimum. Four inches of depth would be better.

There are several ways to build a flue. Just one of them is right. So you do not have many things to distinguish between in this respect. First, the flue must be as straight as it is possible to make it. Second, engineers have proved that a round stack is better than a square one. A square one is more efficient than an oblong one. It is not easy to make it round, building as we do with rectangular bricks, so the next best thing is to make it square. There is less friction in a square flue than there is in one that is oblong with the same cross-sectional area. Less friction means better draft, quicker movement of the smoke and a brighter fire. Since this

is true we ought to do everything we can within reason to decrease friction in the flue. One way to do this is to plaster its inner walls with cement mortar as smooth as we can make it. But this plaster may fall off or it may crack. If one of these things happens and an opening is thus afforded to the masonry, then—if the masonry should crack or the mortar fall out of the brick joints—we would have a defective flue. How many times have you read in the newspaper that Mr. So-and-so's house caught fire through a defective flue? Let us eliminate the whole villainy of the defective flues by lining them with tile. It is utterly foolish to build a flue for a residence fireplace without using these tile liners. They are required by many city ordinances. Now, if you carry the flue up above the roof—high enough, in fact, so that it comes well above the ridge of the roof—you will not have any back drafts blowing the smoke in the flue downward. Have a separate flue for every fire. That is a principle always to be observed. Thus we have built a good fireplace; put in as good a throat as we can with masonry, and a flue that carries the smoke away as it should; what more can we do? Well, we can make the throat a flexible affair. The conditions of the fire are not uniform. More heat and less smoke at one time and more smoke and less heat at another—just the combinations that prevent good operation of a fireplace. Engineers have studied this problem and have devised a mechanically operated throat made of metal that can be opened more or less depending on the condition of the fire. There are a number of good devices of this kind on the market; that shown in one of the illustrations is not necessarily the best. The principle is to have a damper in the throat that can be operated from the hearth or front of the fireplace and adjusted to the conditions of the fire from time to time as may be necessary. The additional expense is small, and its use is recommended if you mean to have a real fire in the fireplace.




If the Flue Must Angle Be Sure the Angle Is Right

Proper Treatment of the Flue and Fireplace Adds a Note of Distinction to Any Room; Right, How the Wind May Blow down the Flue If It Is Too Short

## HAWAII TO FORM A CONTINENT SCIENTIST PREDICTS

According to a New York scientist who has made a special study of movements of the earth, the Hawaiian islands are gradually pushing up out of the ocean, and within a generation, will form a territory as large as Japan. The change will take place without serious shocks, he says.

## HOW FOLKS EARN THEIR LIVING SHOWN BY BUSINESS SURVEY

During the increase of population in the United States from about 24,000,000 in 1850, to more than 105,000,000 in 1920, a lack of uniformity in increase in many occupations was noted. Some entirely disappeared, new ones, like auto driving and electrical work, came into prominence, and others showed little change. In 1850, to every 1,000,000 inhabitants there were 1,323 wheelwrights, but the class has nearly disappeared today, while 1920 found an army of 7,587 machinists to every million inhabitants as compared with the 1,039 in 1850. The proportion of clergymen is nearly the same today as seventy-five years ago, the reports showing one for every 949 persons in 1850, and one for every 912 in 1920. The relative number of physicians and surgeons has decreased, blacksmiths have been greatly reduced, and but 519 sailors were found to each million inhabitants in 1920 as compared with 3,044 in 1850. There were twenty-five times more plumbers to each million in 1920 than in 1850. Electricians numbered 2,014 to the million in 1920, steel workers 8,006 and barbers almost as many.

## AUTO DASH LAMP SLIPS IN PLACE WITHOUT HOLES OR CUTTING

A dash lamp for automobile instrument boards, which can be slipped onto the edge of the panel, does not require the use of tools, drilling of holes or other preparation. Electric connection is quickly made and the light is firmly held against jarring or wobbling when the car is in motion. In case the arrangement of instruments on the board is to be altered, the lamp can readily be removed or its position changed without defacing the surface of the panel.

## GAS MASKS FOR ARMY ANIMALS TO SERVE IN TIME OF WAR

Although the use of poison gas in warfare may be outlawed, the United States army will be prepared to protect its carrier pigeons, horses, mules, dogs and other animals from the fumes should occasion arise, for special masks have been devised to shield beasts and birds in the service. The protector for horses and mules consists of a cheesecloth bag which covers the nostrils and upper jaw only, for they breathe only through the nose so that it is not necessary to cover the mouth. Their eyes need no protection against tear gas for they have no tear ducts. The dog mask is similar, but covers both upper and lower jaws. The pigeons will wear no protectors while in flight, but will be guarded from gas by a special shield entirely covering their transport cages.

Ready for a Gas Attack; Horse and Dog Wearing Cheesecloth Masks and Rider Garbed in Complete Protective Suit

## RUBBER JEWELRY LATEST FAD

Strings of rubber beads closely resembling glass gems, have appeared in the Paris shops, to be worn while bathing. With these novelties are shown swimming suits of light rubber that cover the wearer from neck to feet, so that a person may take a dip without getting wet.

## SUNBURN COLLAR AND BUOY COMBINED FOR BATHERS

Worn deflated, a rubber collar being marketed in Germany protects the neck and shoulders of swimmers from sunburn.

Collars Inflated and Being Used to Buoy Up Swimming Beginners; When Flat, They Protect against Sunburn

Blown up and held in position by the chin and back of the head, it acts as a buoy to aid beginners in swimming and those who wish to go long distances through the water. The cushion is very light in weight, yet will hold up two persons in bathing costume or one soldier with his pack, tests are said to have shown.

## THEATER FAR UNDER EARTH AMUSES IRON MINERS

Two hundred and thirty-five feet beneath the surface, a theater in a northern Minnesota iron mine is believed to be the lowest auditorium in the world. Originally installed for instruction in safety, the theater has developed until now the underground workers are entertained at noon hours and other spare time with theatrical and other amusements. The cavern is comfortable, with good lighting and heat. Music is largely furnished by the workers, the concertina being the favorite instrument.

## OIL WELL DIGS OWN GRAVE WHEN GAS BLOWS OUT

How an oil well dug its own grave and then proceeded to bury its 115-foot derrick in a hole large enough to hide a city office building is the story of one of the giant "gassers" that blew in from a depth of 3,650 feet near Los Angeles not long ago. The drilling crew had taken every precaution against such an accident as the well was known to be in a high-pressure zone. It was cemented but this protection had little effect on the gas, which blew out with it vast quantities of sand and water. The eruption continued for thirteen days. The well showed no trace of oil during the disturbance. The water was fresh and was conducted to adjacent farms where it was used for irrigation. While "gassers" are common, they rarely cause such deep craters and often the derrick can be used again.

## ELECTRIC SANDER IS PORTABLE AND REACHES CORNERS

For finishing automobile bodies, metal furniture, safes and various kinds of metal work, a portable sanding machine, operated by a motor and mounted on a stand with casters for quick moving, saves time over hand-filing and buffing methods and produces more satisfactory results, according to the manufacturers. Flat disks coated with a hard cutting material whirl about by means of a gear in a flexible shafting. They can be used edgewise or on the broad surface, are easily removed and are so flexibly adjusted that they yield to irregular areas such as sharp curves, moldings and beadings. The motor is attached to a swivel base which permits swinging it halfway around.

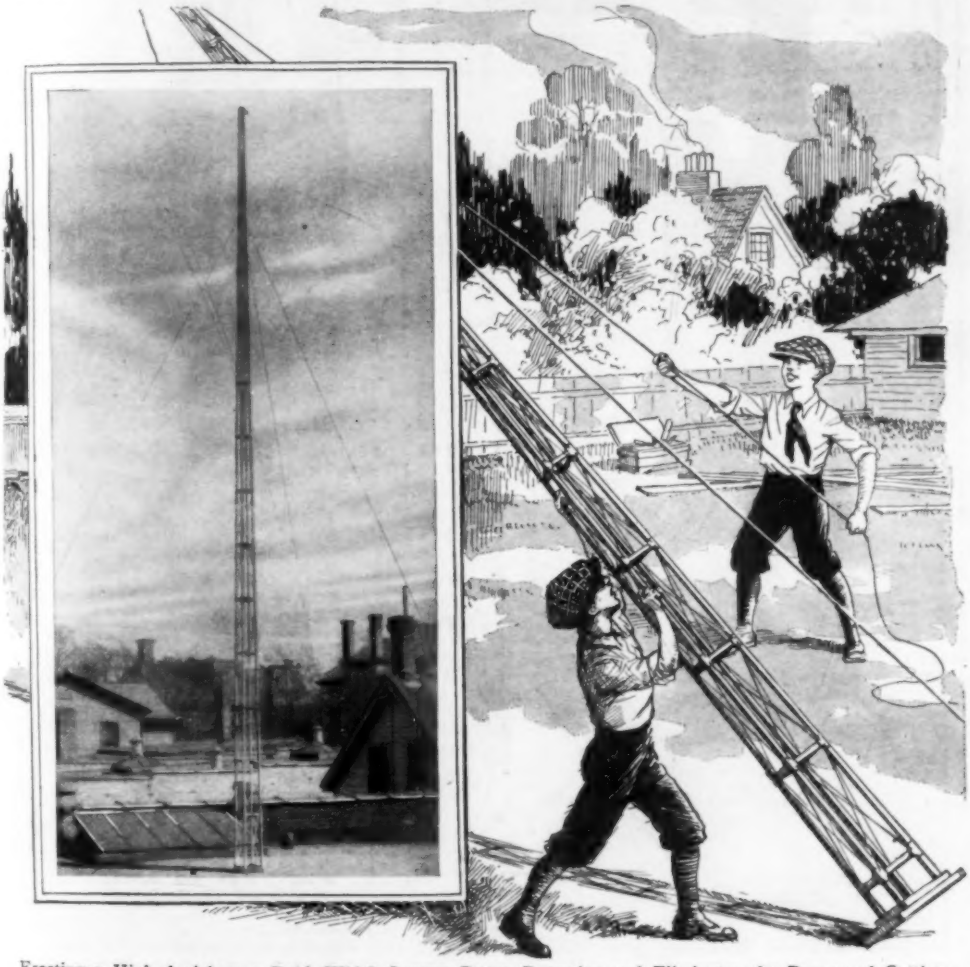
Buffing Surface with Portable Finisher Showing How It Is Adjusted for Beading

# Building a Neat, Sturdy Radio Mast

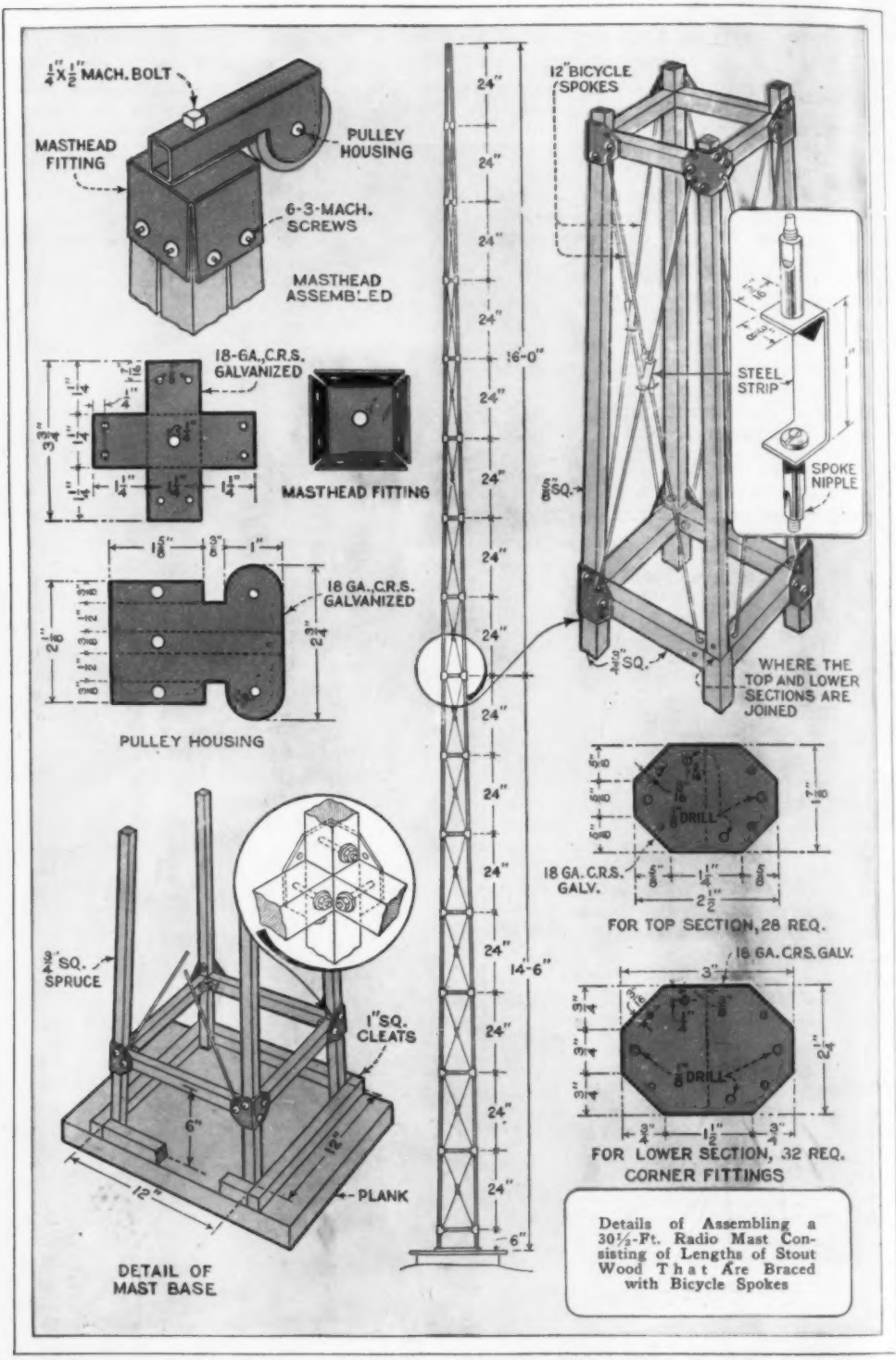
By F. D. BURKE

HEIGHT is an important consideration in erecting an outdoor aerial. A mast of light weight and maximum strength, which can readily be made by a boy, is the solution of many an aerial-erecting problem, especially on an apartment-house roof, where usually so many are found that it is nearly impossible to put up another without touching or running close to some already there, which means interference from other sets. When one gets up 30 ft. above the roof there is much less trouble. The mast is built in two sections, each consisting of four spruce longitudinals and crosspieces tied together with galvanized sheet-iron fittings and braced with ordinary bicycle spokes. The lower section is 14 ft. 6 in. high, and the wooden parts are ¾ in. square. The upper section is 16 ft. high and its wooden members ⅝ in. square. The wood parts for both sections can be cut from two boards 16 ft. long, 10 in. wide and ⅞ in. thick. If spruce is not obtainable, fir or hard pine will do. The angle fittings are cut from No. 18 gauge galvanized sheet steel, in accordance with the dimensions shown in the detail drawings. They are attached to the longitudinals and crosspieces by 6-32 round-head machine screws, each screw being provided with a nut and washer. The fittings are spaced as shown.

The builder should start assembling the mast by first bolting all the fittings to the longitudinals, which should then be con-



Erecting a High Aerial on a Roof, Which Insures Better Reception and Eliminates the Danger of Getting Tangled Up with Other Aerials



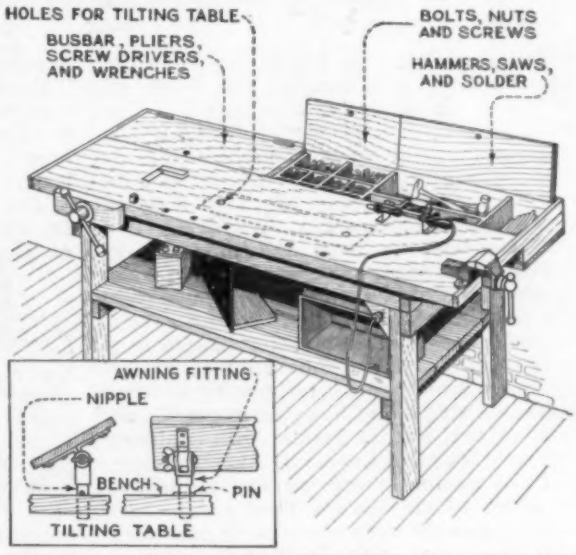

Details of Assembling a 30½-Ft. Radio Mast Consisting of Lengths of Stout Wood That Are Braced with Bicycle Spokes

nected in pairs by the crosspieces. The partial assemblies are braced with bicycle spokes. The method of attaching these spokes to the fittings is clearly shown. Finally the two sides of a section should be connected by the remaining crosspieces. The upper ends of the four longitudinals for the top section are brought together and capped with a fitting, cut to the shape and dimensions given in detail drawing. It is then bent to shape and attached to the longitudinals. The masthead is provided with a pulley for raising and lowering the antenna. The mast is braced by three lengths of ⅛-in. stranded-steel cable. The total cost of all the material need not exceed $10. If greater height is desired more sections can be added, in which case the bottom section should be constructed of ⅞-in. square stock and the two upper sections of ¾ and ⅝-in. stock.

## Handy Workbench for the Radio Fan

Every radio fan, who builds and experiments with different kinds of receivers, needs a workbench. One that is especially designed for this purpose is shown in the illustration. The special advantage of this bench is that it incorporates a tool box under part of the top, permitting easy access to the tools at all times, and has a tilting table on which the work can be held in any convenient position.

The bench is made of 2-in. wood, except for the lower shelf, the tool box and the lids, which are of 1-in. stock. The top should be made of well-seasoned oak or maple. The shelf adds rigidity and also provides a good place for unfinished sets, cabinets and batteries. The tool box is arranged at the back of the bench top. It is about 6 in. deep, and is divided into compartments. One is used for pliers, screwdrivers and wrenches, the second for heavier tools, such as hammers, saws and drills, and the third is divided into smaller ones, to hold screws and nuts of different kinds and sizes. In the center of the bench, where the worker usually stands, a tilting table is provided which makes it possible to clamp the radio set to it at the most convenient angle. This table is simply a piece of 1-in. wood, such as maple or oak, about 30 in. long and 7 in. wide. It is attached to two awning fittings and 5-in. lengths of pipe to be set in holes drilled in the bench top as indicated. Provision should also be made for an electric soldering iron, which every radio builder should possess. The plug is located on the front of the bench near the right side, where it will be handy. Sheet-metal brackets screwed to the bench top make a good rest for the iron. Two vises are attached, one fixed and the other movable. If desired, the lid on the tool box, which is divided into three sections to cover the three compartments, can be equipped with latches to permit locking them with a padlock so that the youngsters cannot run off with the tools. If not so equipped the covers should have finger holes bored for lifting them.—L. H. Georger, Buffalo, N. Y.




Handy Radio Workbench Saves Many Steps; Insert, Method of Mounting the Tilting Table

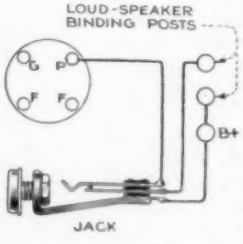
## Building a Loud Speaker in Standard Cabinet

Receiving sets with loud speakers contained inside of the cabinet are on the market and this feature has a decided advantage in that the risk of upsetting the outside horn and ruining the finish of furniture is entirely eliminated. The amateur who is building his own set can likewise incorporate the horn in the cabinet, and do a good job. Even the cutting of the grill is easy, although it takes time, care and patience.

Loud Speaker Can Easily Be Built into Cabinet, and Adds Much to Convenience; Left, Horn Mounting; Upper Right, Top View of Set, Note Phones in Corner; Below, Front of Set Showing Horn Grill in Panel

As is obvious from the photograph, which shows three views of a built-in loud speaker and the grillwork on the panel, the arrangement is simple. A loud-speaker unit of wood, otherwise contained in a neat box, was used on account of its appropriate size, good tone quality and remarkable volume, although any small loud speaker that will fit inside of the cabinet will do. This loud speaker was 9 in. long, and the cabinet therefore had to be 9½ in. deep, which is a standard size. Two angle brackets were screwed to the neck of the horn and to the back of the cabinet, a small wedge was slipped under the horn and a wood screw driven through This holds the horn securely without permitting any vibration between the horn and the cabinet. The front of the horn should clear the panel about ⅛ in., for if it touched, the slight vibration of the horn against the panel would spoil the tone. This arrangement makes the loud speaker a permanent fixture in the cabinet, so that it is not removable with the panel and baseboard, the latter being cut out so that it will clear the horn about ½ in.

The speaker may be connected to the set inside of the cabinet, so that no cord or plug is visible on the outside. This method of connection makes it necessary to wire the set so that the loud speaker works all the time except when the phone jack is plugged in, which must then automatically cut out the loud speaker. The wiring diagram shows how this is done. The plate terminal of the last tube is connected to the

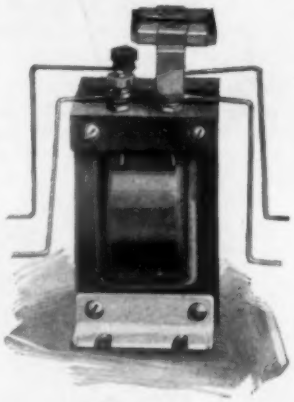


jack. The cord on the loud-speaker unit may be shortened if desired. After the cord is cut, the insulation is carefully removed for about ½ in. on the end, and a short length of No. 26 copper wire is wound tightly around the strands. The ends are then soldered in the cord tips.

The grill may be cut out according to any symmetrical pattern. A simple and neat design, the cutting of which requires little work compared to some of the more elaborate designs, is shown in the photo. The design is first penciled on paper and is cut out. It is then clamped to the back side of the panel and the outline is traced on the panel with a sharp scriber. A number of holes are then drilled to start sawing, which is done with a coping saw, using a metal-cutting blade and cutting inside of the scribed line. Care must be taken in sawing, or the bakelite will chip. Later a small file is used to make the edges true and smooth. A piece of thin silk gauze is glued to the panel behind the grill. This can be done with collodion. Note that there is space for the headphones between the horn and the cabinet.

### Condenser Improves Quality of Reception

A small condenser placed across the secondary terminals of the second-stage transformer in the average receiver will tend to eliminate squeals, and will improve the quality of reception. The size of the condenser can be determined by trial, but one of .00025-mfd. capacity will be found about correct in most cases. The type with the clips usually used for mounting the gridleak on the grid condenser, will be found suitable for this purpose, as in most cases these clips can be bent to fit under the transformer terminals. This is a simple method of improving the set, and can be applied to any type of circuit.



If the phones don't seem satisfactory in operation, try reversing the polarity.

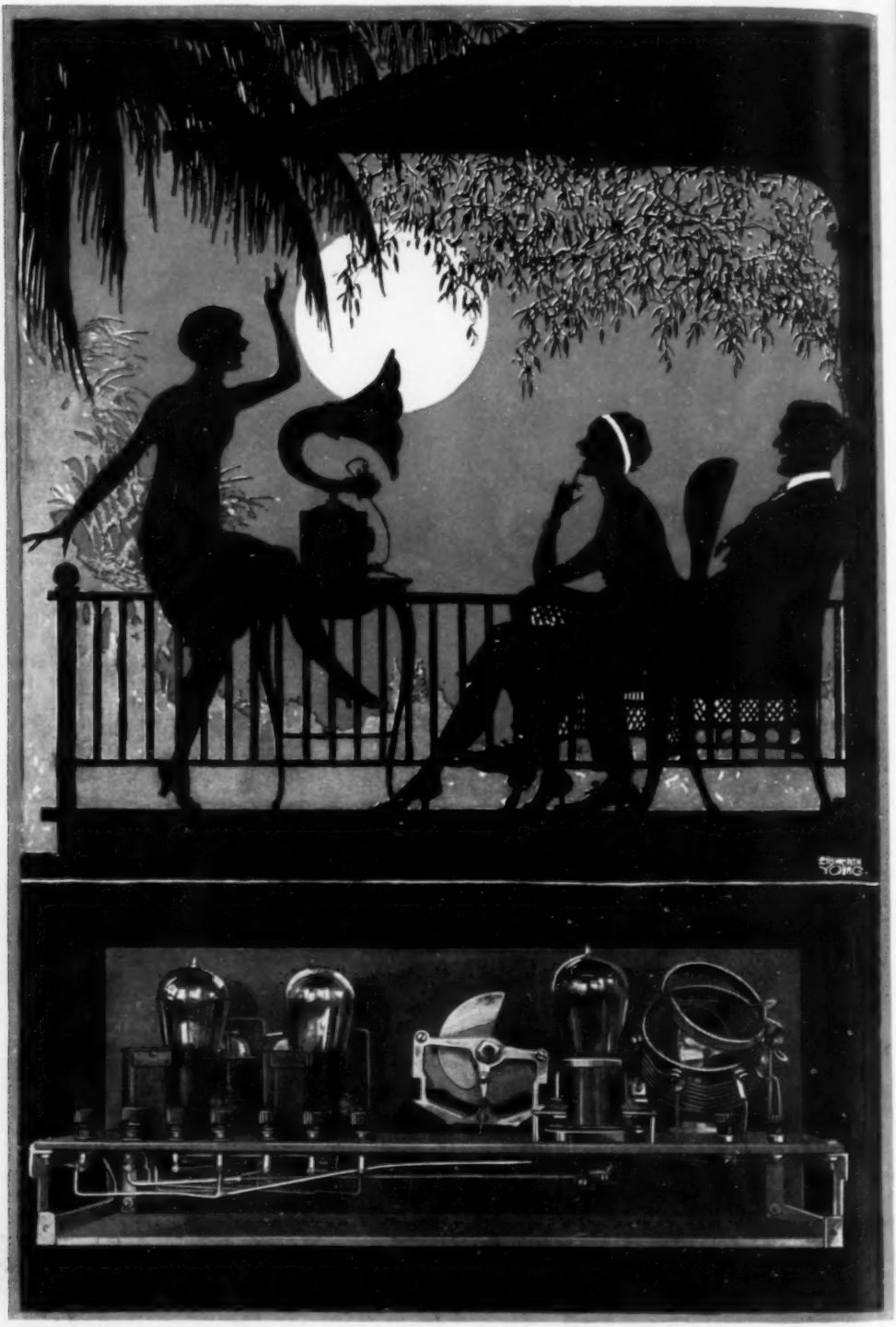
### Discarded Automobile Radiator Makes Good Ground

An excellent ground can be made for the radio set by using a discarded copper automobile radiator, which can be purchased from a junk dealer or at an automobile-wrecking plant. The ground wire is first soldered on, and the radiator is then placed in the ground at a depth of from 4 to 6 ft. A layer of earth, about 1 ft. deep, is tamped down firmly on the radiator, and a layer of salt is sprinkled over this. Alternate layers of dirt and salt are tamped in until the hole is filled. —L. A. Krider, Hatton, Wash.

Worn-Out Automobile Radiator Buried in Yard Makes Good Radio Ground

### Eliminating Hand Capacity

Hand capacity, which makes close tuning difficult, often can be eliminated by mounting the variable condensers farther away from the panel. This can be done by providing a longer condenser shaft as follows: A short length of ¼-in. brass rod, long enough to extend through the panel, is placed in one end of a thread spool and the condenser shaft in the other. If the rod and shaft do not fit tightly, drill them and the spool to take cotter pins. Mount the condenser in the desired position on the subpanel by means of two 1/16-in. brass strips, ¾ in. wide, bent to form brackets of sufficient length to support it.



**Where Static Conditions Are Prevalent Nearly the Whole Year, Short-Wave Receivers of This Type Have Been Found Most Satisfactory**

# Low-Loss Instrument Can Be Used for Both Long and Short-Wave Reception

By F. L. BRITTIN

LOW loss is a much misunderstood term and is often abused. The popular demand for low-loss apparatus has led to the marketing of improved instruments, however, by which losses are materially reduced. The newer types of inductances and condensers are far superior to those used a short time ago. The three-tube receiver described in this article was built in Popular Mechanics' radio laboratory with special attention to the elimination of losses and, in exacting tests, has given entire satisfaction.

A second main feature of this receiver is its wide range, from 50 to 550 meters, permitting its use on the lower wave bands, which although still in the experimental field, are of general interest. Many of our readers in the warmer countries tell us that they are getting excellent results on the short waves and have less interference of static, which is troublesome in the tropics the greater part of the year. The extreme low range of this receiver is obtained by the substitution of a tuner unit wound for the shorter waves, for the unit used to bring in the longer ones. The connections of both units are the same, so no rewiring is necessary. The set only costs $36.00 to build. The instruments on the front panel are all of the one-hole mounting type, which greatly simplifies the work of assembling.

The tuner unit is of the three-circuit type and will tune practically any radio circuit. It consists of an untuned primary, a main or secondary inductance, and a tickler or feedback coil. All of these coils are brought to separate taps and may be connected in various combinations. The untuned primary is of the adjustable coupling type and can be set for volume and selectivity to suit any aerial.

When wiring the circuit, make all leads as short and direct as possible. The front panel can be of any good insulating material such as bakelite or formica. The tuner unit is mounted at the extreme right, next the condenser, and then the two rheostats, which are of the carbon-pile type and take up very little space. The filament switch is mounted below the tuner and the condenser, and the horn jack is located below the rheostats. The subpanel is mounted on metal brackets, which are screwed to the front panel by means of four ½-in. nickelplated, 6-32 brass machine screws. This makes a strong assembly, and the brackets are sufficiently high to

Anyone Who Is Able to Use a Few Tools Such as Pliers and Screwdriver Can Readily Build a Set of This Type

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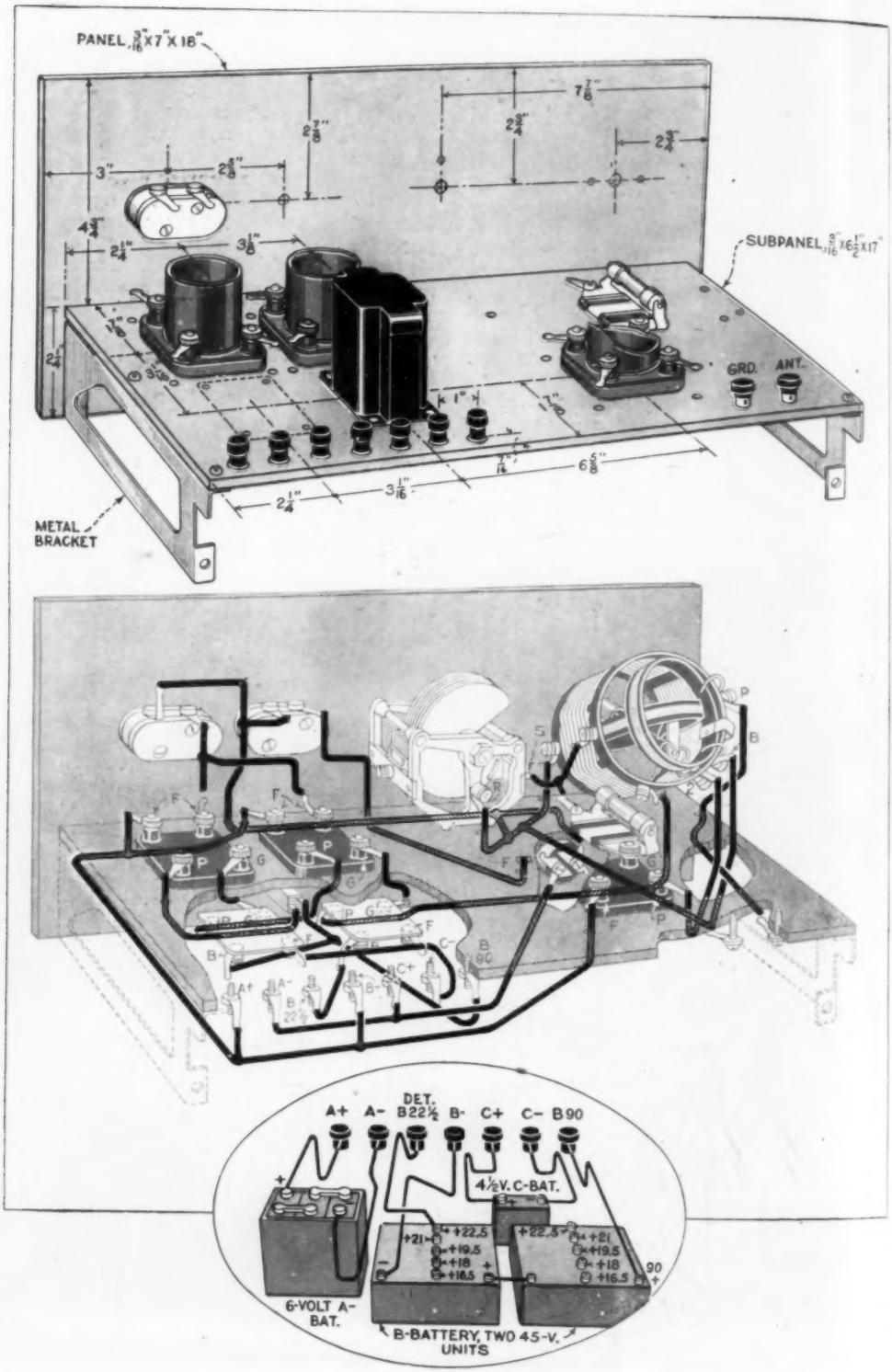
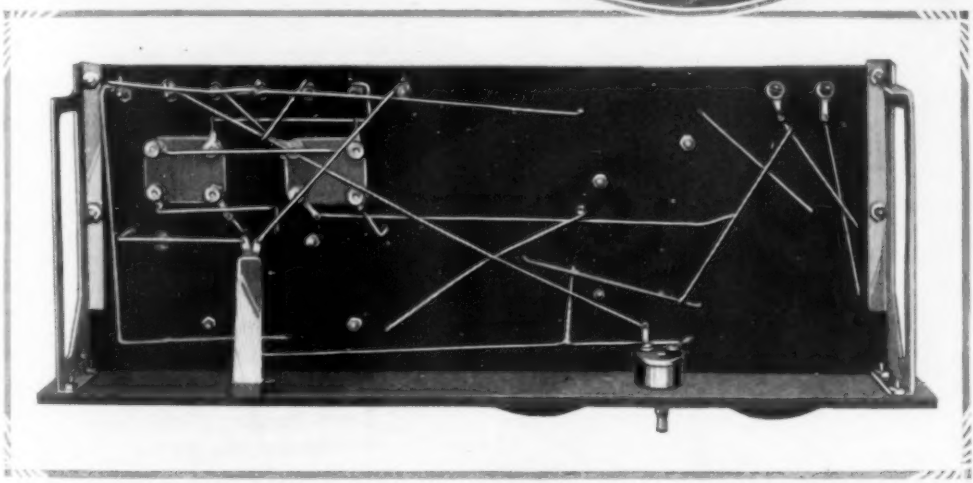
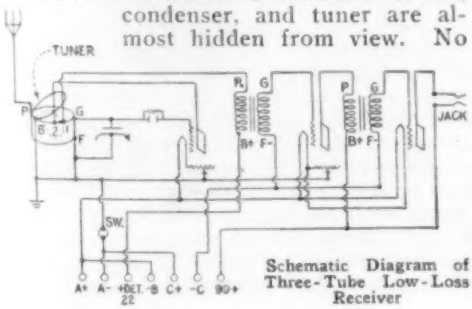

PANEL, 3/16" X 7" X 18"
SUBPANEL, 3/16" X 6 1/2" X 17"
METAL BRACKET
GRD.
ANT.
DET. B 22 1/2
A+
A-
B-
C+
C-
B 90
4 1/2 V. C-BAT.
6-VOLT A-BAT.
B-BATTERY, TWO 45-V. UNITS
+22.5
+21
+19.5
+18
+16.5
90

permit almost all the wiring to be concealed under the subpanel. The binding posts, tube sockets and audio-frequency transformers are mounted in the position shown in the diagram. They are of the subpanel-mounting type. Holes are drilled in the subpanel for the terminal screws, the transformers are inverted, and the terminal plate removed, after carefully marking both the plate and the transformer shell so that the terminal plate will be in the correct position on the underside of the panel. Before screwing the knurled nuts on the transformers, place a tinned copper lug on each terminal. Use these lugs on all terminals of the instruments. The detector-tube socket is located directly behind the tuner and variable condenser, the .00025-mfd. grid



Almost All of the Wiring Is Concealed underneath the Bakelite Subpanel So That Only the Instruments Can Be Seen from Above

condenser is equipped with gridleak clips, and a 2-meg. gridleak of the cartridge type is used. Holes are drilled in the subpanel at points close to the instruments so that the leads from the sockets, condenser, and tuner are almost hidden from view. No spaghetti tubing is used, except at points where crossing wires are liable to touch each other. All connections are carefully soldered, taking care that no soldering flux gets under the terminals, as this would introduce resistance. Use solid-wire solder and a minute quantity of good soldering flux, which contains no acid. Best results are obtained when the paste is wiped off before applying the iron.




Schematic Diagram of Three-Tube Low-Loss Receiver

It will be noted that but one jack is used. This eliminates losses, and volume can be controlled by proper manipulation of the tuning controls so that either phones or horn can be used. The jack is of the open-circuit type. The condenser dial controls the wavelength, and is used to select the desired station. The tuner

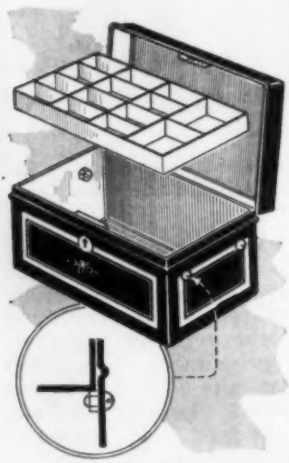
dial is used to control the volume, and obtain the clearest possible signals. Adjust the primary coil down near the secondary for loud signals, and up, or away from the secondary, for greatest selectivity. When once found, the adjustment of the tuner seldom requires changing, except to bring in distant stations. The left-hand rheostat controls the filament of the detector tube, and the right-hand rheostat controls both amplifying tubes. These rheostats never should be turned higher than necessary to get good results. Learn to tune a receiver so that it will not reradiate. When the set is oscillating it is transmitting, and this will interfere with your neighbors' sets. Keep the tuner dial adjusted just below the point where beats or whistles are heard. These sounds are sometimes heard at times when the set is not oscillating and may be caused by two stations operating at nearly the same wavelengths, but in that case will have a constant note.

**MATERIAL LIST**

1 bakelite or formica panel, 3-16 by 7 by 18 in.
1 bakelite or formica subpanel, 3-16 by 6½ by 17 in.
1 B-T low-loss tuner, type B, 200 to 565-meter range.
1 B-T low-loss tuner, type SW, 55 to 150-meter range (for lower wave bands only).
1 B-T 250 MMF, type L, variable condenser.
2 Bradleystats.
9 binding posts.
1 grid-condenser, .00025-mfd., with gridleak clips.
1 gridleak, 2 meg.
3 standard sockets.
2 vernier dials.
1 4½-volt C-battery.
2 Thordarson a.f. transformers, 3½ to 1 ratio, subpanel-mounting type.
1 open-circuit jack.
1 filament switch.
2 Benjamin shelf-supporting brackets.
4 doz. tinned copper lugs, long type.
8 6-32, ½-in. nickelplated brass machine screws, with nuts.
5 2-ft. lengths of No. 14 tinned copper wire.

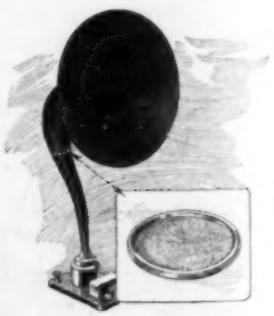
## Handy Radio Tool Chest Made from Cash Box

The average radio builder does not take proper care of tools and small parts, which are usually scattered about and never at hand when needed. The little tool box shown in the drawing is easily made and will cost much less than the manufactured type. Procure a tin cash box, 12 by 8 by 5¼ in. in size. Make a tray, 1 in. deep, either of tin or light wood (such as cigar-box wood) and divide it to suit the individual need. This tray is supported in the box by means of four 8-32 round-head brass screws, placed through holes bored in each end of the box, and secured inside the box with nuts. The method is clearly shown in the illustration. The projecting screws hold the tray in position when it is placed in the box, the screws being run through the sides of the box at a point to bring the top of the tray, when in position, level with the top of the box. The tray provides space for small screws, nuts, and odds and ends, while the larger compartment below affords room for such tools as pliers, screwdrivers, etc. The tool box can be made of wood if the builder prefers, but the cost of the tin box is so low that it will appeal to the majority.—Lester P. Young, Culver, Ind.



## Loud-Speaker Diaphragm Modulates Tones

Claimed to eliminate all harsh sounds when inserted in the horn of a loud speaker, a modulating diaphragm has lately made its appearance on the market. It consists of a soft felt disk held in a grooved nickelplated ring, and is placed in the throat of any sound-emitting instrument, such as a radio horn, phonograph, cornet, etc., in the manner shown in the illustration.

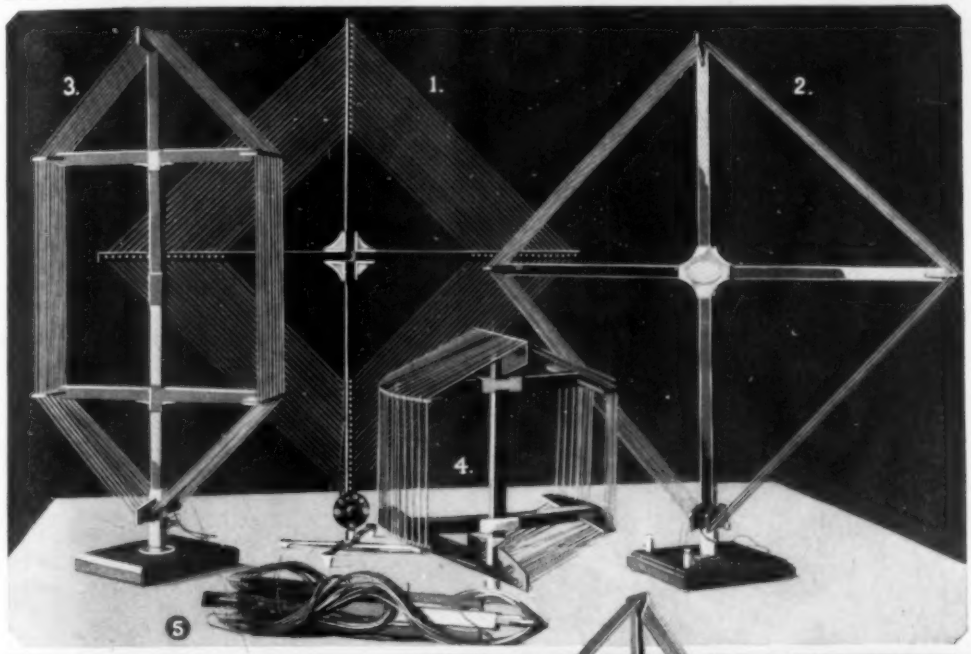


# Loops; How to Select and Use Them

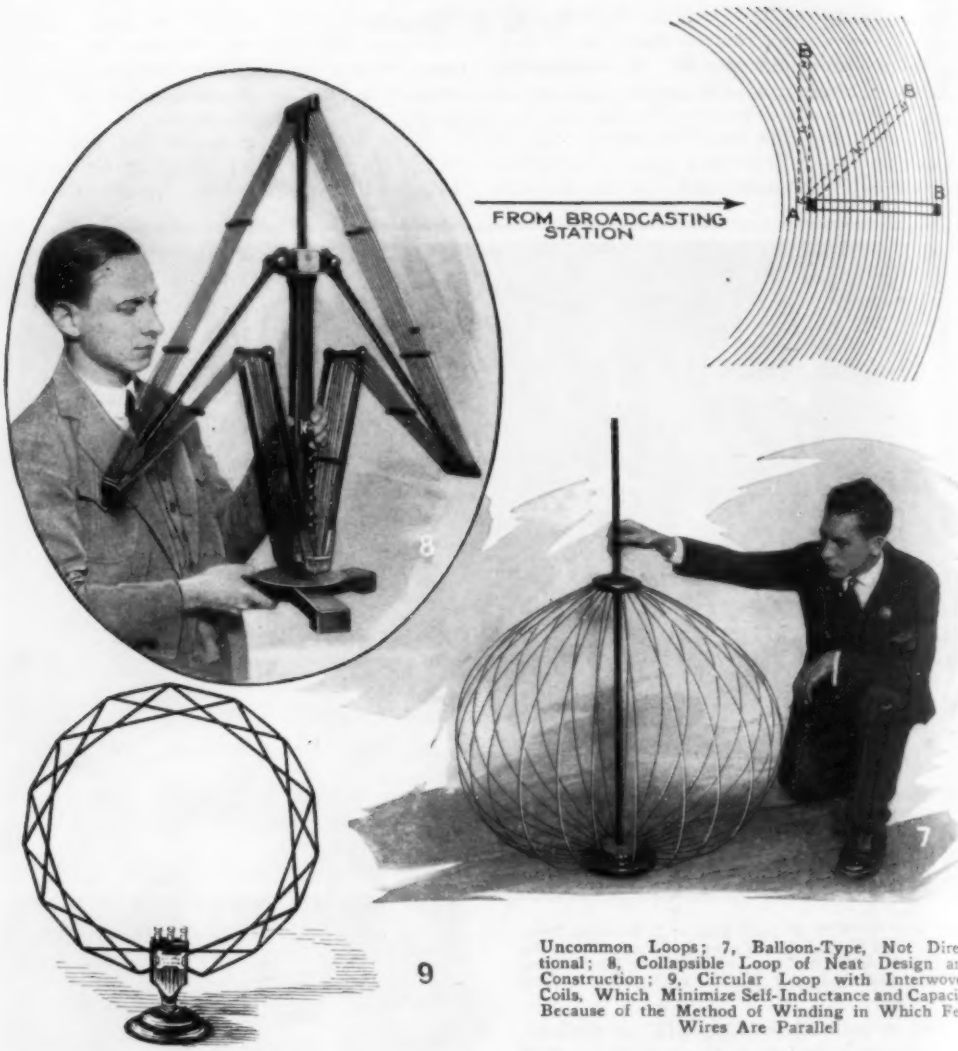
By E. R. HAAN

CHIEFLY because of its selectivity and comparatively small pick-up of atmospheric disturbances, the loop is rapidly replacing the outside aerial. When one first uses a loop on a receiver that has previously been operated with an outside aerial, a loss of volume will be noticed, but this will be more than compensated for by the improvement in the quality of the reception. Of course, this does not mean that any receiver will work on a loop. Small sets having less than three tubes will not, and many other sets have to be changed to make them work on a loop satisfactorily. In general, the tuning inductance necessary with an outside aerial is not used with a loop-operated set, as the loop itself is the inductance. Radio-frequency amplification is necessary, however. One stage of r. f. amplification has been found sufficient on some types of receivers but three stages are better. Some three and four-tube reflex sets are designed to operate on a loop, but usually do not give as good results as a set embodying r. f. amplification, a detector and two stages of transformer-coupled a. f. amplification, or three stages of resistance-coupled amplification.

Most loops in general use are directional; that is, they have to be pointed toward the broadcasting station as in Fig.



A Few of the Most Popular Loops; 1, Pancake Type; 2, Diamond-Shaped Box Type; 3, Console Type, Exposed; 4, Console Type, Inclosed; 5, Small Loop Folded, and 6, Proper Method of Rotating a Loop



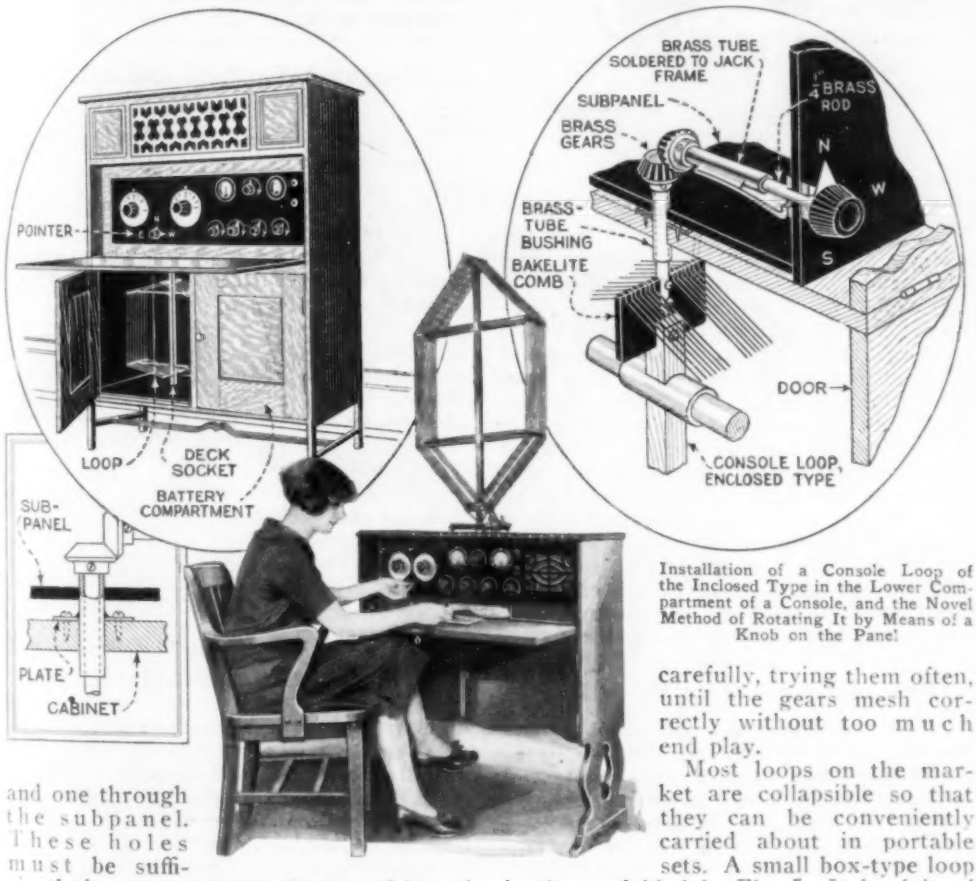

**Uncommon Loops; 7, Balloon-Type, Not Directional; 8, Collapsible Loop of Neat Design and Construction; 9, Circular Loop with Interwoven Coils, Which Minimize Self-Inductance and Capacity Because of the Method of Winding in Which Few Wires Are Parallel**

6, to obtain the loudest reception. On many sets signals can be tuned out entirely by turning the loop at right angles to the station from which the signal is coming. When at right angles to the direction of the broadcasting station the waves strike both halves of the loop simultaneously, setting up currents in opposite directions, which neutralize each other, resulting in no signal. When turned at a smaller angle to the path of the waves the latter strike one side of the loop winding before the other side, so that a current is set up in the wires in the same direction. This effect is greatest when one side of the loop winding is pointed directly toward the station, and consequently the efficiency of the loop in receiving signals from that station is highest in this position (see Fig. 8).

There are two general types of loops in common use, namely, the pancake type, shown in Fig. 1, and the box type, shown in Figs. 2, 3 and 4. Both types have their advantages and disadvantages. Greater selectivity is claimed for the former and greater volume for the latter. The loop shown in Fig. 3 is designed to turn in a small radius. This makes it possible to set it on a console, against a wall, whereas, if either of the loops shown in Figs. 1 and 2 were used, it would be necessary to place the console across a corner. Fig. 4 shows a small box loop designed for the inside of a console. In this way it is entirely out of sight, and is turned by means

of a small knob or dial mounted on the panel. A loop of this kind can be put in any console and will operate satisfactorily without loss of selectivity. Owing to its small size, 13 in. high by 11½ in. wide, it cannot be expected to give the volume obtained on larger loops. When used with the Popular Mechanics superheterodyne eight, however, very little loss of volume was noticeable.

The method of installing such a loop is clearly shown in the detail drawing. The loop is set into a grommet or deck socket fastened to the bottom of the lower compartment. A short length of ¼-in. brass rod, the length depending on the height of the control knob on the panel above, is slotted about ¾ in. to fit on the bakelite comb on the loop, and fastened to the comb with two small brass screws. Careful measurements are taken and holes are drilled, one in the bottom of the instrument section of the console and one through the subpanel. These holes must be sufficiently large to accommodate a section of fairly heavy brass pipe or tubing having an inside diameter of ¼ in. This acts as a bearing for the brass rod. A plate of 1/16-in. sheet brass, about 2 in. long and 1 in. wide, is drilled for the brass tube and for two small screws, soldered to the pipe and screwed to the top surface of the bottom of the instrument compartment. A small brass miter gear is fastened to the top of this vertical rod. The horizontal rod is also of ¼-in. stock, slipped through a similar tube; the tube is soldered to the frame of a jack, which is fastened to the panel in the usual way. Another miter gear is fastened to the end of this rod to mesh with the first one, and a knob with a pointer is fastened to the rod in front of the panel. Turning this knob rotates the loop. The letters N, S, W and E should be engraved on the panel so that the operator may readily know the position of the loop. It will be found necessary to leave both tubes a little long when cutting them off, and then to file the ends carefully, trying them often, until the gears mesh correctly without too much end play.




Installation of a Console Loop of the Inclosed Type in the Lower Compartment of a Console, and the Novel Method of Rotating It by Means of a Knob on the Panel

Most loops on the market are collapsible so that they can be conveniently carried about in portable sets. A small box-type loop is shown folded in Fig. 5. It is claimed that the receiver can be tuned to some ex-

tent, with the balloon loop, Fig. 7, because it can be folded to various shapes. The small basket-woven circular loop, shown in Fig. 9, is claimed to have a minimum self-inductance and capacity.

Most loops contain about 80 to 90 ft. of wire. Both ends are connected to the receiver at the aerial and ground binding posts, and no ground connection is used. Some loops have an additional binding post between those connected to the ends. This is used for regenerative purposes, where the loop is energized as is done in some circuits. Other loops, such as the one shown in Fig. 1, are tapped and equipped with an inductance switch, with which it is possible to decrease the amount of wire used on the loop. Such a loop has been found quite an aid in increasing selectivity of some sets.

### Tool Combines Coil Winder, Former, Cutter and Vise

A handy radio tool now available combines several useful tools in one. It is

Made to Clamp to the Work Table, This Handy Coil Winder Is Five Tools in One

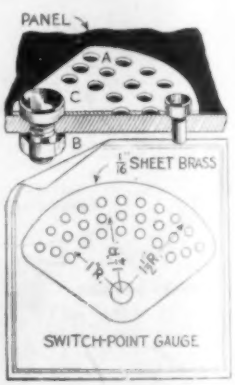
clamped to the work table as shown in the illustration, and consists of an adjustable coil winder fitted with an automatic counter; it is provided with two cone disks for holding straight tubes, or rotors. The end of the shaft is provided with two steel pins, and, by means of these, uniform loops can be made to fit No. 6 or No. 8 screws or binding posts. Another useful feature is the wire cutter, which is shown at the right of the counting device. The tool is also equipped with a vise, and a flat metal surface is provided on which light hammering can be done. The arm holding the spool of wire for coil winding is clamped in the vise, the movable jaw being notched to hold it.

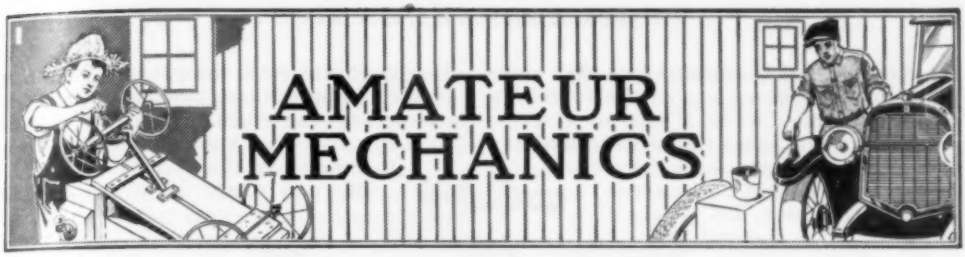
### How to Select a Good Phone Plug

Avoid plugs having loose tips that can be unscrewed readily. If the plug is of this type, loose contact will result, and dust accumulation will in time impair reception. Insecurely fastened terminals cause noises and loss of volume that are often attributed to the set. Good insulating material is also necessary. Choose plugs that improve the appearance of your set; for example, do not use a large plug on a small panel. If the plug is marked with a red terminal receptacle, this side of the plug should be connected to the high-voltage B-battery lead. Trace the connections in the jack and see that the proper part of the plug makes the corresponding connection in the jack. Some of the better-made loud speakers have an indicating red cord for the high-voltage B-line and this must be correctly connected through the plug and jack in order to obtain best results.

### Convenient Jig Facilitates Drilling for Switch Points

The gauge shown in the drawing is for laying out switch points accurately on the panel, and is a great timesaver. A piece of 1/16-in. brass sheet is cut to the shape shown in the illustration, the large hole at the bottom being drilled to suit the bushing through which the switch is fastened to the panel. To accommodate the various switch-lever lengths, lay out three circles of holes, in radii of 1, 1¼ and 1½ in. To use, drill the hole for the bushing as shown in the upper illustration, lay the jig on the panel and insert the bushing. Place the switch lever in the bushing to determine the radius necessary for drilling the switch-point holes. Drill one switch-point hole and mount a switch point; this will hold the jig tight to the panel. The remainder of the holes can now be drilled, and they will be found to be exactly spaced, a difficult thing to do without a jig of this type, or some form of template.—H. G. Bauman, Chicago, Ill.






# When the Sink Is Clogged

## Simple Methods of Cleaning Sinks That Can Be Employed by the Housewife and Handy Man

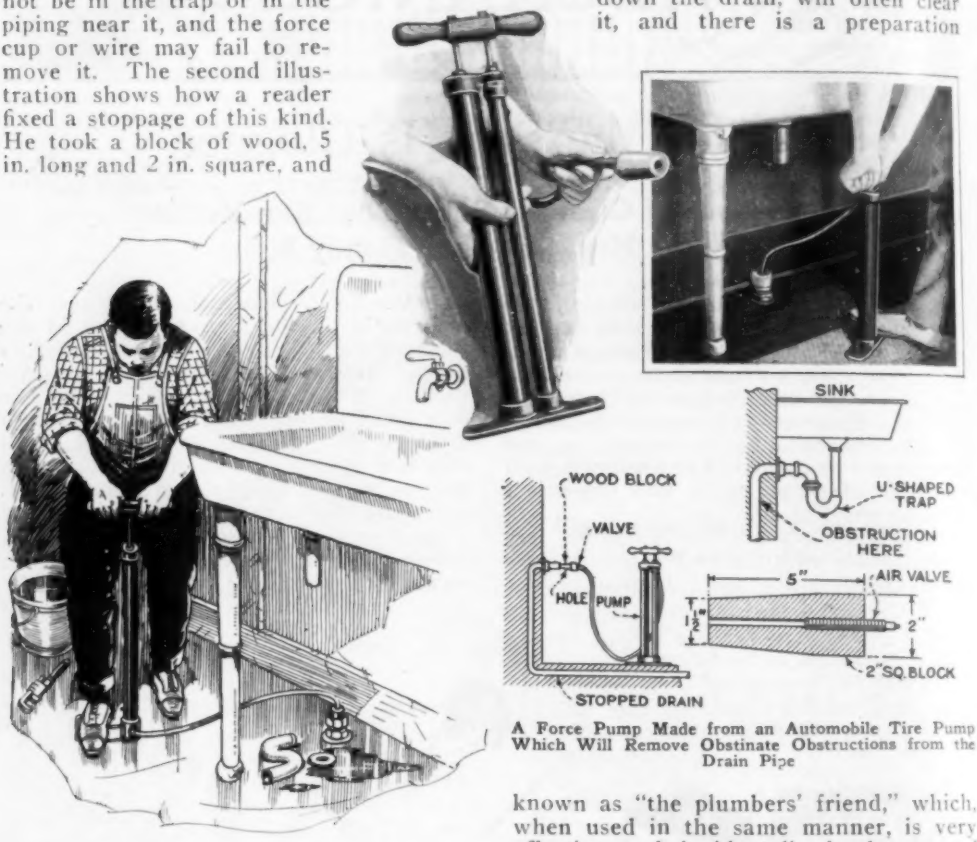
WHAT do you do when the sink gets stopped up? Do you call up the janitor or the plumber, and do without using the sink until he arrives with his tools? In nine cases out of ten there is no need to call in outside help when the water in the sink fails to flow away, as the trouble can be cured in a few minutes with a couple of simple tools, and sometimes with no tools at all.

In the first place, there would be very little trouble with the sink if a little care were taken in its use. Pouring coffee grounds and tea leaves down the sink is simply inviting trouble, yet many people do this habitually. Strainers that can be set in one corner of the sink, and into which the coffee and tea-pot can be emptied may be purchased very cheaply, and it is just as easy to pour the contents of the pot into the strainer as into the sink. Also, dish water that is heavy with grease should not be poured into the sink until the grease has been "cut" with a liberal quantity of soap powder.

When the sink does become clogged, first try to clear it by allowing the water to flow until there is three or four inches of water in it. Place the hand over the sink outlet in the manner shown in the illustration, the palm being slightly cupped, the heel of the palm raised, and then drive the palm down sharply. The column of water under the hand will often dislodge the obstruction in the pipe. If this fails, a common plumbers' force cup may be obtained, and this will usually remove the obstruction. In the absence of a force cup, which, however, should be a part of the equipment of every home owner's tool box, the sink screen can be removed and an improvised pump plunger made from a rag padded around the end of a stick, so that it will fit tightly in the outlet pipe. The plunger is raised and lowered gently in the pipe until it is cleared. The pipe should be full of water to the top before the plunger is placed in it. One precaution should be observed in the use of both the force cup and the plunger. If the sink is not freed after about a dozen strokes, do not use the tools again until the plug has been removed from the trap and a fairly stiff wire run through the pipe, in both directions, in order to locate the obstruction, if possible, and help to

Above, Cleaning a Stopped-Up Sink, Using the Hand as a Force Cup; Left, the Plumbers' Force Cup and an Improvised Plunger

remove it. If the stoppage is a very complete one, continued use of the force cup or plunger may force a leak in a screw joint. In some cases the obstruction may not be in the trap or in the piping near it, and the force cup or wire may fail to remove it. The second illustration shows how a reader fixed a stoppage of this kind. He took a block of wood, 5 in. long and 2 in. square, and rounded and tapered it until one end would fit into the drain pipe, after the trap had been removed. A hole was bored through the center of the block, of such a diameter that the valve from an old inner tube could be screwed into it tightly. When the wooden plug was driven into the end of the pipe and the pump connected to the valve, a few strokes of the pump sufficed to clear the pipe. It is necessary, of course, to remove the wing end of the valve before it can be screwed into the plug, but this is easily done with a hacksaw.




**A Force Pump Made from an Automobile Tire Pump Which Will Remove Obstinate Obstructions from the Drain Pipe**

Many people use lye to clear out the sink. Lye should never be used for this purpose; it will only make the trouble worse. In one case the use of lye necessitated the taking up of a complete length of drain pipe underlying a cellar floor, which, fortunately, was merely of earth, in order to clean out the drain. The lye had combined with the grease in the pipe to form a hard soap, and had completely stopped up the drain. Potash or caustic soda, dissolved in hot water and poured down the drain, will often clear it, and there is a preparation known as "the plumbers' friend," which, when used in the same manner, is very effective, and, incidentally, is also one of the best things to use for cleaning out automobile radiators when they have become coated with deposits from hard water, as it will not injure metal.

## Killing Weeds Chemically

Weeds that spoil the appearance of city lawns, can be effectively eliminated by the use of sulphuric acid, applied to the weeds separately, according to William H. Dehn, a member of the American Chemical society. This seems to be a laborious method, but although it takes time to do it, only one application is necessary and there is no other labor to do. From one to ten drops of concentrated sulphuric acid is applied to the center of each weed, depending on its size. The work of treating a large number of weeds can be done best by means of a glass dropping funnel of medium capacity. There are two meth-

ods to do the work. The acid may be applied to the largest weeds at random, and those not treated the first time may be treated the next day, and so on until all the weeds have been exterminated. The second method is to cover only a small portion of the garden at once, treating every weed that can be found. It is advisable to delay watering the lawn for several hours after the acid has been applied to the weeds, as water will wash the acid away. Furthermore, this would tend to spread the acid over the grass with the result that this also might be killed. All kinds of weeds can be killed with this method, but dandelions are most troublesome, owing to their large roots and quick propagation. It has been found that one pound of acid per year is sufficient to keep 1,000 ft. of lawn free from weeds. Weeds should not be allowed to go to seed, if effect is to be permanent.

## Farmer Builds Pleasing Garage from Silo Blocks

While we were building a circular tile silo it occurred to us that we could build a garage in the same way, which we proceeded to do. The garage was made 19½ ft. in diameter. Two windows and a double door of the usual swinging kind were provided. A large workbench was built on one side, and this left space for oil and gasoline tanks. A garage of this type is not only novel and pleasing in appearance but requires less building materials. — Floy Bates, Hardin, Mo.

Novel Circular Garage on Farm Is Built from Silo Blocks

## Folding Holder for Basement Clothes Line

Many housewives use the basement for drying the wash on rainy days, but seldom have a convenient method of fastening

Convenient Clothes-Line Supports Attached to the Joists

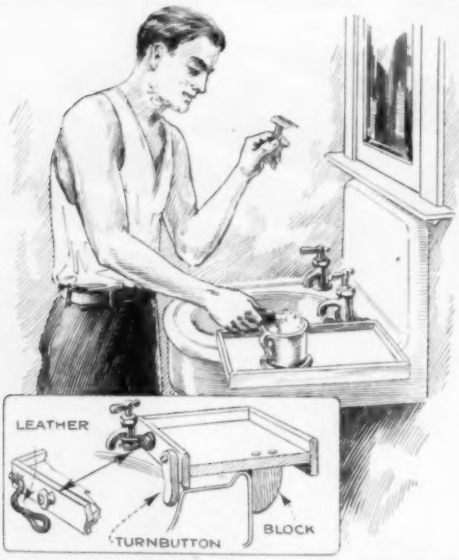
the clothes line. The device shown in the illustration provides a simple, space-saving support for a number of lines, and when the lines are removed it can be swung out of the way and locked against the ceiling, as shown. It is made of 2 by 4-in. lumber and extends 12 to 18 in. below the joists. The length of the supports will depend on the number of lines to be suspended. A 3-ft. width, however, gives ample space for several lines. The frames are hinged to the joists so that the ends of the upright pieces butt against the lower edge of the joist, and the two hangers should be placed so that the pull of the lines is against the joists. Nails or small hooks on the upper edge of the crossbars provide anchoring places for the lines. — Lowell R. Butcher, Des Moines, Iowa.

## Destroying Caterpillars on Grape Vines

The grapes in the back yard were being destroyed by the caterpillars, which could be found under all the large leaves. The vine was almost dead when the owner began to cut off all the large leaves and those eaten by the caterpillars. This allowed the sun's rays to reach the grapes and destroyed all the caterpillars.

### Shaving Shelf for the Lavatory

In the small bathrooms found in many apartments a detachable shelf for the lavatory will be found very handy for holding shaving equipment. Such an accessory is simple to build. Plane a piece of 1-in. pine, 6½ by 11½ in. in dimensions, and miter around the edge a piece of round-edge molding, ⅜ in. thick and 1½ in. wide, allowing a projection below of ½ in., while the round edge rises ¼ in. above the shelf. Notch the end strips to fit over the roll on the lavatory, and nail underneath the center a block, about 3 by 3 in., the vertical edge being placed 3¼ in. back from the edge of the shelf, which bears against the faucet. Now put the shelf on the edge of the lavatory with the end against the lavatory back, and mark the position of the faucet. Allowing about 1½ in. for the width of the faucet, nail a short length of ¼-in. round leather to the edge of the shelf by means of staples. Pass the leather around the faucet, to measure for length, allowing enough stock for the 1½-in. loop shown in the detail. Bevel off the end and bend it back against the thong, and bind it with thread. Make a button just large enough to permit the loop to be slipped over it, and screw on the edge of the shelf. A turnbutton, with one end 2 in. long, is placed near the center of the edge, where it will clasp the bowl of the lavatory when turned. In use, the thong is buttoned around the faucet and the turnbutton turned into the bowl, holding the bracket against the lavatory apron. The dimensions given above fit the 17 by 21-in. lavatory, but the shelf may be varied to fit other types. It should be finished with three coats of good flat white paint and one of white enamel.




Small Shelf on Edge of Bathroom Lavatory Proves Handy for Shaving

### Don'ts

An analysis of accidents resulting from the misuse of electrical equipment has led a large electric service company, says the New York State Committee on public utility information, to draw up the following list of "Don'ts" for users:

Don't tinker with bare wires, even in your own home. Ambulance rides are unpleasant.

Don't leave the cord attached to the electric iron while you attend to other household duties. If you want to see a house burn, they do it better in the movies.

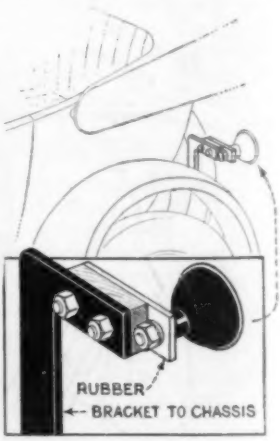
Don't use the electric vibrator while in the bathtub. You may receive one big unexpected vibration that will make future bathing unnecessary.

Don't hang lamp cords over a nail. Frayed insulation may mean a short circuit.

Don't hang electric-light bulbs against wooden walls or partitions. And don't cover lamps with tissue paper.

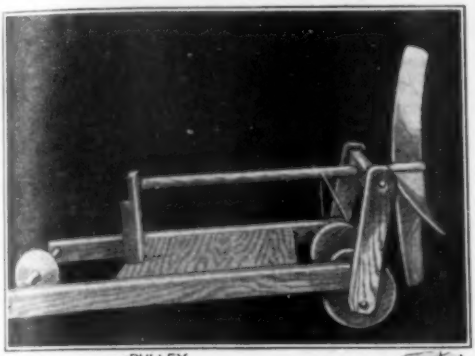
### Tail-Light Shock Absorber

The filaments of auto tail-light lamps are frequently broken by shocks. This can be prevented to a great extent by mounting the lamps on rubber arms, as shown in the illustration. A strip of rubber, about 1½ in. wide and 3/16 in. thick, is bolted to the end of the bracket with a wooden distance piece between them if needed. The holes can easily be drilled through the rubber by means of a sharpened brass tube, using water as a lubricant. Other types of tail lights may be used by slightly altering the attachment.

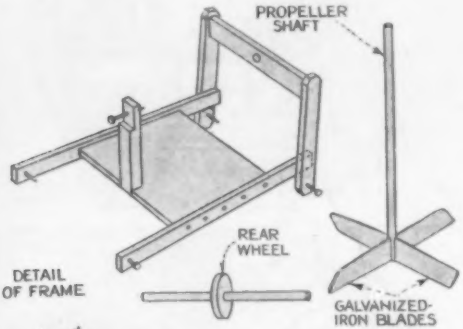


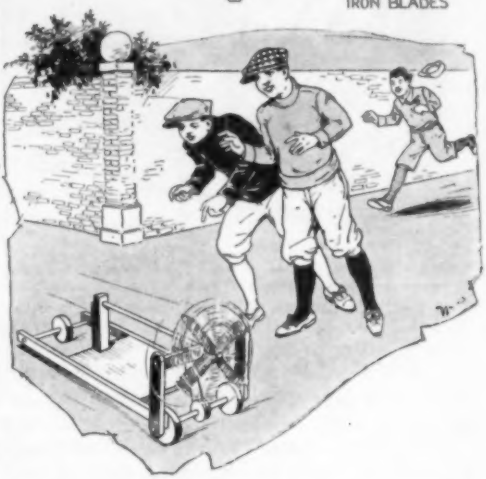
### Wind-Propelled Toy Wagon

Any boy will be interested in a toy wagon equipped with a propeller, which drives it ahead against the wind. It is made entirely of wood with the exception of the propeller blades, which are cut from some light sheet metal. The proportions of the various parts of the wagon can be approximated from the photos and drawings. The wagon has three wheels, although four can be used if desired. The wheels are fixed rigidly on the axles, and the latter are held to the frame by means of nails driven into them through holes that serve as bearings, as shown. The propeller shaft is also of wood and is mounted, in the same manner as the wheel axles, in the short upright at the rear and through a crosspiece in front, so that it extends beyond the crosspiece sufficiently for the mounting of the propeller. This is made from two short lengths of light sheet metal, each being bent over at right angles in the center to form two blades, and inserted in the shaft, for which purpose the shaft is split as shown. The blades are then twisted to give them the necessary pitch. A twisted cord over the propeller shaft and around the pulley between the front wheels transmits the wind power to the wheel axle, thus driving the car forward against the wind.—R. W. Wagner, Ayrshire, Iowa.




Self-Propelling Wind Wagon That Any Boy Can Build; It Consists of a Light Wooden Frame and Has a Sheet-Metal Propeller Which Drives It against the Wind with Surprising Speed



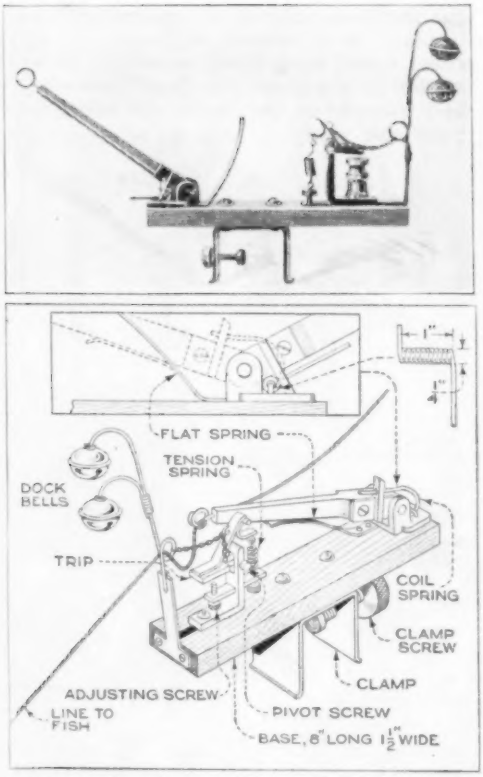



### Lino-Fronted Easel Makes Pinning of Paper Easy

Pinning bromide paper to the wooden easels generally used with enlarging apparatus is a difficult job, as a fair amount of pressure must be used to force the pin into the easel, and this pressure may force the easel out of adjustment.

By covering the front of the easel with thick cork linoleum, these difficulties are at once overcome, for the pin is forced into the surface with the slightest pressure. Moreover, the lino is elastic, and the holes made close up again, so that the easel front always shows an even surface.

A piece of thick linoleum is cut to the same size as the easel board and glued to the latter. While the glue is setting, a board of the same size as the easel is clamped over the lino-covered front, to make sure that the surface will be smooth all over. The bromide paper is pinned on in the usual way. The thickness of the linoleum should be such that the point of the pin cannot penetrate it.




Novel Fish Trap Sounds an Alarm Every Time a Fish Is Caught

## Novel Fish Trap Never Fails

The fish trap shown in the illustration was designed to operate on the order of a spring mousetrap. It has been used for two seasons and has never failed to accomplish its work; when the fish bites, the trap does the rest. It is especially convenient for the fisherman who uses several lines at the same time, as it makes it unnecessary for him to watch the lines constantly, and all he has to do is to release the fish from the hook when the bells indicate that one has been caught.

A block of wood, about 8 in. long, is used as a base. On the underside, a clamp and screw are arranged for fastening it to the edge of a rowboat or dock. A wooden lever is pivoted at one end of this base, and two springs are used to give it a strong thrust when the trap is sprung: a flat one in front to give the initial thrust, and a small coil, of the mousetrap type, behind, to pull it backward and hold it down. The trip should be made for accurate adjustment and can be assembled from the bell-ringing mechanism of an old telephone. It consists of a vertical piece to which a small crossarm is pivoted. One end of the crossarm is arranged so as to project just over a pin near the end of the lever, to hold it down. The tension of the trip on the pin is adjusted by a small coil spring and screw, to suit weather conditions; if the water is smooth, the trip should hold the pin down very lightly, but if it is rough, the trip should hold it down more securely. The trip is also connected by a chain to a vertical metal arm that is attached to the end of the base, and holds two bells that ring instantly when the arm is jerked. At the same time, when the arm is pulled forward, the chain will tighten and release the trip. The chain should be adjustable so that its length can be varied. The fish line is securely fastened to the ring at the end of the lever, and inserted between the turns of the coil on the flexible arm, just tight enough to allow the line to pull the arm forward for releasing the trip. The entire outfit can be made of odds and ends and does not involve much expense.—F. F. Howe, Milwaukee, Wis.

## Sawbuck Holds Cordwood Immovable

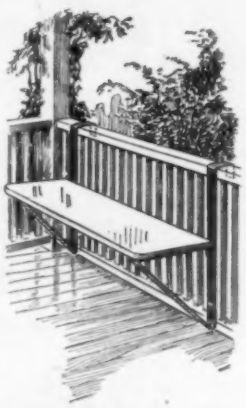
Numerous methods are used to prevent cordwood from turning in a sawbuck, but the most satisfactory one I have used is shown in the accompanying drawing. Sections of an old discarded crosscut saw are bolted to the sides of the sawbuck by means of wooden strips, as shown. The teeth of the blades bite into the log and prevent it from turning or rising.—C. M. Wilcox, Torrington, Conn.

Sections of Saw Blade Fastened to Sawbuck Prevent Wood from Turning

### Improving Ground for "Tulite" Bulbs

"Tulite" bulbs in the headlights of Ford cars sometimes cause trouble by the lights flickering when the wiring is known to be good. In such cases the headlight sockets, if shaken by means of the plug at the rear end, will cause the light to dim or go out. It is often found that the sleeves attached to the headlamp shell, and in which the sockets slide, are rusty and dirty, caused by rain driving in between sleeve and socket. The sockets are also covered with rust. The dirt at this point causes a poor ground—or none at all—for the bulbs, in which both filaments are grounded through the headlamp shell to the frame. The remedy is to wrap sandpaper about the little finger or a stick and polish the inside of the sleeve and the outside of the socket. Many of the sockets are a loose fit and can move sidewise in their sleeves, thus causing a poor ground and too much vibration for the bulbs. A remedy is to pinch the end of the sleeve in the headlight slightly with pliers, until the socket is a free sliding fit, with no sideplay. As there is an open-end slot cut in the sleeve for the focusing lug on the socket, this can be easily done. To reach the sleeve in the headlamp, the lens, bulb, reflector-focusing screw and socket must be taken out of the lamp, and for best results they should be focused after the work is completed.—E. T. Gunderson, Jr., Humboldt, Iowa.

### Improvised Porch Seat



With the bracket shown in the drawing a long seat may be arranged at the porch railing, so that it can be removed and stored away quickly. Form the bracket of heavy flat stock, and rivet it securely at the joint. Be sure to have the seat pitch toward the back a trifle, so that it will be more comfortable. After the brackets are hung up, an ordinary 2 by 12-in. board is laid across them. Rugs or robes thrown over the seat will make it more comfortable.—Louis Schneider, Clinton, Mo.

### Unusual Paper Weights

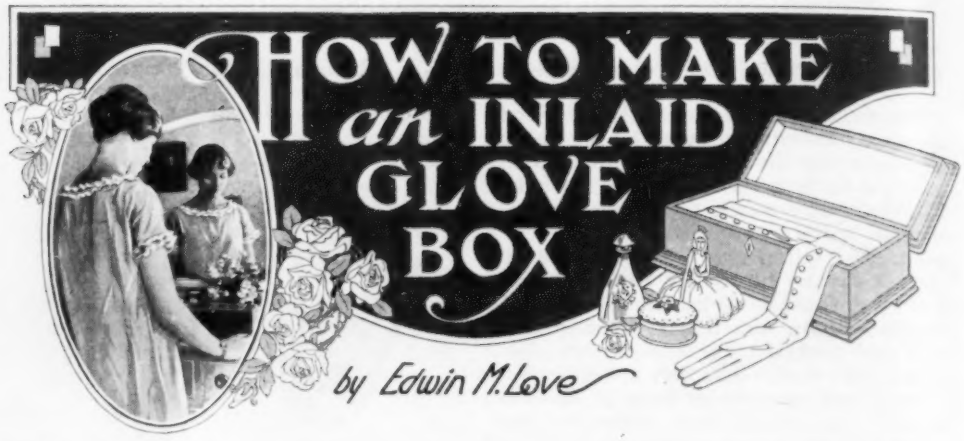
The photo shows paper weights holding the impression of my boy's hand and foot,

Baby's Foot and Hand Cast in Metal Make Interesting Paper Weights

taken when he was five weeks old. He is now a man and the paper weights, which are still in use, are interesting souvenirs.

I made them in the following way: Impressions of the foot and hand were taken in dentists' compound, and from them molds were made by pouring plaster of paris into the impressions. When the plaster had set the impression and mold were separated and the rest of the mold shaped as desired. The castings I had made of brass in a foundry. After finishing them by rubbing with emery cloth, they were polished and goldplated. If no dental compound can be obtained readily, ordinary paraffin or wax can be used. It should be worked soft and the impression then taken. By immersing it in cold water immediately it will harden at once, which is necessary to prevent it from bending and thus ruining the impression. —C. H. Tillotson, Los Angeles, Calif.

¶To paint a monogram or other device on leather do not use oil paint, which will spread, but mix some coach color, which is ground in japan or turpentine, and thin it with a little turpentine, adding a little carriage-finishing varnish as a binder.



# How to Make an Inlaid Glove Box

by Edwin M. Love

FOR the man who likes to use tools, inlaying offers a field full of the pleasure derived from the construction of a beautiful and useful article. Carefully done, it is by no means beyond the skill of the average home mechanic.

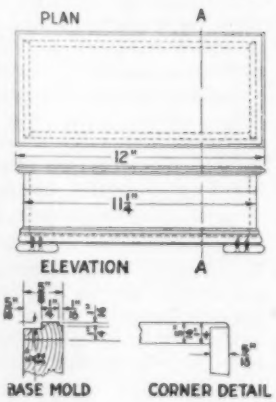
The glove box illustrated was built of Tobasco mahogany, inlaid with pyralin "ivory," a material well adapted to such work because of its toughness and the ease with which it can be worked. Any beautifully figured hardwood is suitable, but only fine material should be used for so small an article, in which the handwork is the main item.

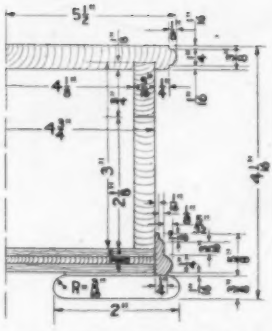
Make the top of stock ⅜ by 6 by 12 in., sized to 5½ in. in width and 12 in. in length. Surface very carefully, testing for wind or twist by sighting over straightedges placed near each end of the piece. Set the smoothing plane down for a fine shaving, and finish with a scraper. If the grain is very curly, as is likely to be the case with figured wood, it is advisable to do nearly all the surfacing with a scraper. Gauge for thickness and surface the other side to the line. Use the best side for the top.

The molded edge is detailed in the sectional drawing, Fig. 1. If no molding plane is available, rabbet the ends and edges 1/16 in. deep from the faces and ⅛ in. wide, afterward planing to roundness the corners of the tongue so made. If the ends are done first, splitting of an edge can be taken out when that edge is molded. Sandpaper roughly.

Use the same care in the preparation of the stock for the ends and sides. Make the ends exactly 5/16 by 3 by 4⅝ in., and the sides 5/16 by 3 by 11½ in. The ends of the sides are rabbeted to receive the ends of the endpieces (see Fig. 3). Lay out the shoulder marks 10⅝ in. apart, squaring from the face edge, and, using the outside as the face side, gauge lines 1/16 in. from the face across the ends and to the depth of the rabbet. Stand the piece in the vise and rip as in Fig. 2, splitting the line. When the rabbets are ripped, cut out the waste wood

Fig. 1




HALF-SECTION THROUGH A-A

across the grain, Fig. 4, and mark the second side by the first. If the cut across the grain is made first, there is every chance that a miscut will spoil the piece. Unless the wood is very close-grained, size the end grain of ends and sides with liquid glue, and lay aside to dry.

Make about 3 ft. of ⅝-in. molding for the base of the box. Fig. 1 details this. Put a piece of ⅝-in. stock in the vise and rabbet one corner to a depth of 5/32 in., with a width of 5/16 in., while the other is rabbeted 1/16 by 1/16 in. Bevel the resulting corner in the wide rabbet, and with a small gouge carve the ⅛-in. cove. Round the raised corners to obtain the elliptical profile, afterward ripping the molding off.

Now scrape off surplus sizing glue and assemble the box by clamping the ends from the sides, Fig. 6, using blocks to prevent clamp bruises. Place these directly over the joints to avoid splitting the rabbet or opening the joints. If another pair of clamps are available, place them endwise; but if not, allow the glue to set a little, and then remove the side clamps to draw the ends up. Replace again on the sides. Square carefully, and then nail

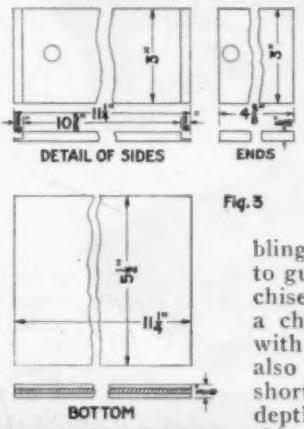



Fig. 3

Fig. 2

Fig. 2, Ripping an End Rabbet; Fig. 4, Cutting Out Waste Wood in Rabbet

over the bottom a piece of 3/8-in. three-ply panel veneer, using 1-in. brads driven at various angles to increase their holding power. This bottom piece may be cut accurately to size or may be nailed on and trimmed later (see Fig. 6).

When the glue is dry, remove the clamps, trim the projections of the sides and bottom, and smooth up. Gauge a pencil line 9/16 in. from the bottom to guide the molding, which is mitered around and glued in place by spanning the clamps over the bottom with blocks bearing against the flats of the molds and the box sides, to prevent scars. This is easier said than done, but it can be done, and neatly. No nails should be used where they will show.

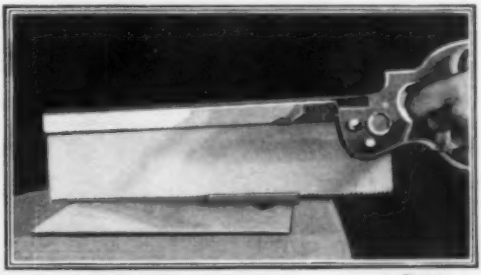


Fig. 4

Lay the top, face down, on a bench, stand the box on it with even margin around, and scribe for housing into the top, marking one end for identification in assembling. Draw lines 5/16 in. inside the first to guide the grooving. Use a ¼ or 5/16-in. chisel for the cuts with the grain, cutting a chip every ¼ in., and trim the edges with a wide chisel. Use a wide chisel also across the grain, but only advance a short distance on each cut. Groove to a depth of ⅛ in. Figs. 7 and 8 illustrate this process. Pyralin is obtainable at art stores in sheets as small as 10 by 12 in., which cost $1.50 for 40-ply. Trace or cut out the inlay patterns and paste them to the ivory with glue, as in Fig. 10, and cut out with a jewelers' saw, which can be borrowed from almost any jeweler or art metal worker. A coarse blade, 3/16 in. wide, is fine enough. Trim with a half-round needle file, beveling all places where undercutting is insufficient. Place the figures on the top as indicated in the photos, Figs. 1, 11 and 12. Holding each solidly, trace around it with a sharply pointed soft pencil. Lay aside the inlay, and carve out the mortises with a small gouge or knife. Beginning at the center, score across the grain with the knife point, removing chips with a light shearing cut, holding the handle in the right hand while the forefinger of the left guides the point. Avoid cutting too deeply. When near the outline, proceed more slowly, finally trimming almost to the

line with a rocking motion of the point, as in Fig. 11. If the outline is carefully followed, the inlay will clamp in so tightly, that aside from the change of color and texture, the joint cannot be seen.

Fill with glue and sawdust any too deep places in the mortises; lay in a heavy coat of celluloid cement and clamp in the inlay, using a scraper blade to protect from bruises.

Assemble the top with the box. When dry, scrape off all glue spots, and rub the moldings smooth with 00 sandpaper, using a small piece wrapped around a thin strip of wood, as shown in Fig. 12. Pay heed to the corner joints, bringing the profiles down to match without any dubbing off. Scrape the top smooth. Now set a pair of dividers or scribers for ¾ in. and scribe the lid joint. Rip sides and ends to this line. Rough off the edges with a plane, lay a sheet of sandpaper on a smooth surface, and rub the box edges to a true, smooth line. Hinge, and dap in lock and keeper. For the key escutcheon, inlay a diamond of ivory.

Grind the point of a three-cornered file to form a cutting tool, and engrave the necessary lines in the figures, filling them to emphasize them. Make the legs as detailed, securing them with two short screws. Shim the inside corners with cardboard.

Give the box a final smoothing up and inspection. With a tiny brush paint over the inlay with shellac, allow to dry, and then paint in the stain, working rapidly to insure evenness of color, and yet carefully, for if the stain strikes through the shellac, it will attack the ivory. If, as with mahogany, there is an open grain, rub on filler previously stained, and rub off across the grain. When dry, shellac,

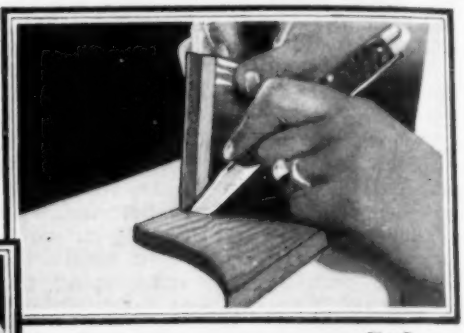


Fig. 5

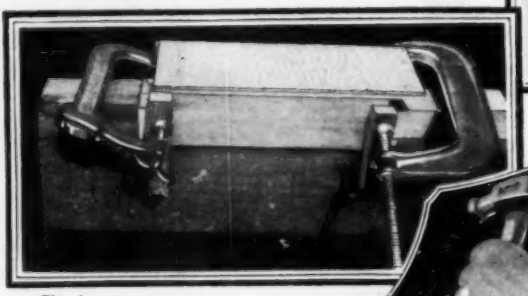


Fig. 6

Fig. 5, Using One Side as Template for Other; Fig. 6, Clamping Box; Figs. 7 and 8, Cutting Grooves in Box for Housing Side and End.

Fig. 7

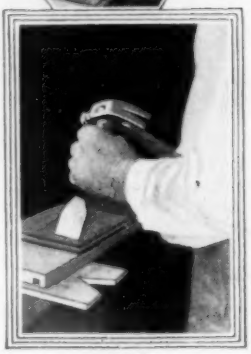


Fig. 8

and give three or four coats of varnish, rubbing each coat down with 000000 sandpaper. Finish by rubbing to a satin gloss with rottenstone and water.

Though not an orthodox method of finishing, the following will be found very satisfactory for the home mechanic. Set the box on a clean newspaper, and pour on the top a considerable quantity of varnish. With a clean, blunt scraper, or a straight-backed knife, level the varnish from center to each end, inclining the scraper in the direction of motion. This results in a heavy coat free from air bubbles, brush marks or bits of lint, the only likely defect being a slight waviness of surface. Next, trace around the molded edge with a varnish brush, avoiding wiping bristles over the top. Brush the sides and ends, working from the center toward the ends. When this coat is thoroughly dry, scrape smooth, rub with 00 steel wool and 6/0 split sandpaper, and repeat the process. To sharpen a scraper for this job, file the edge square, remove the burr, and hone to a gloss on a fine stone, polishing the faces as well as the edge. Clamp it in a vise, lubricate with beeswax, and with a burnisher or smooth gouge and light strokes, turn the corners to form the cutting burrs. This results

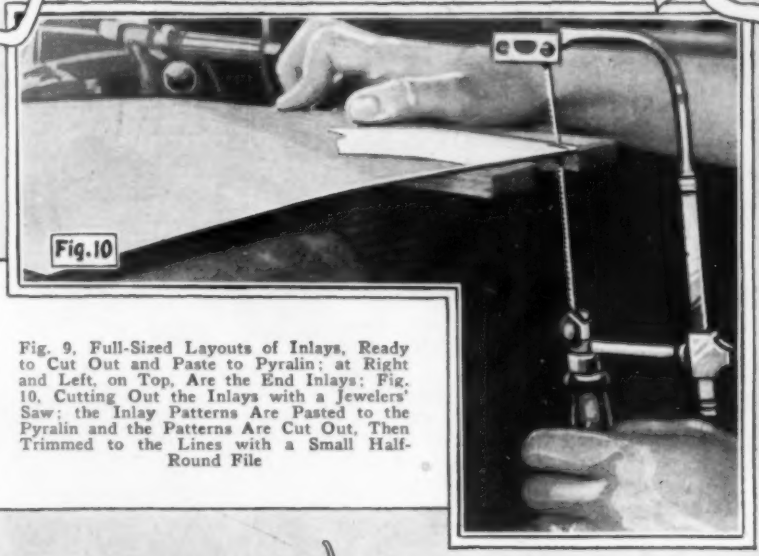



Fig. 9, Full-Sized Layouts of Inlays, Ready to Cut Out and Paste to Pyralin; at Right and Left, on Top, Are the End Inlays; Fig. 10, Cutting Out the Inlays with a Jewelers' Saw; the Inlay Patterns Are Pasted to the Pyralin and the Patterns Are Cut Out, Then Trimmed to the Lines with a Small Half-Round File

Fig. 12

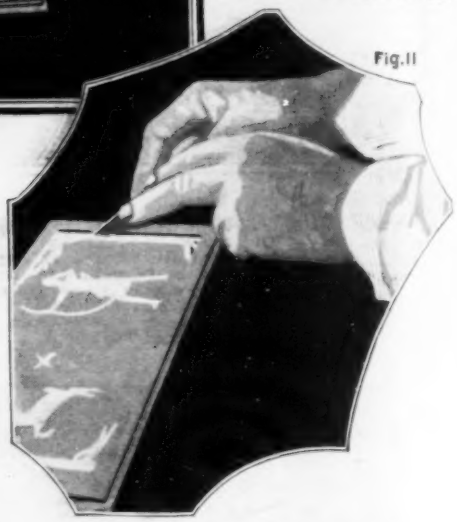


Fig. 11

Fig 11, Trimming Mortise for End Inlay; Fig. 12, Sanding Top Molding

in a fine, keen edge that will not scratch the varnish.

Line the box with silk-covered pads made by covering cardboard forms softened with thin layers of cotton. Put in top and bottom pads, then side pads, and last of all the ends. Glue felt over the underside and feet.

## Intensifying or Reducing Negatives with One Solution

Few amateur photographers are aware that there is a method by which they can either reduce or intensify negatives with perfect safety and ease, and by a formula that is practically fool-proof.

The negative should first be well washed and then immersed in a solution of sulphate of copper (blue vitriol), acidified with a few drops of sulphuric acid. The strength of the solution does not matter, as the effect is gradual and easily watched. The plate assumes a pale cream color, and this must be carried through to the glass back. Then a thorough washing is required. Now comes the point where the final result is to be decided. On the duration of immersion in the following solution depends the intensification or reduction of the negative.

Any of the developers used for paper can be applied as a redeveloper, preferably amidol or hydroquinone. In these, the negative can be restored to its original density; if taken out earlier, a reduction is obtained, or it can be held in the developer until it is of considerably greater depth than before. A trial with a few old negatives will give one familiarity with the peculiarities of this process. It is particularly adaptable to removing halation in interiors or night photos, or converting a slow printer into an ideal negative. All depends on the length of time it is redeveloped. If the back is allowed to become entirely darkened, complete intensification will result, but any objectionable high lights can be left on the back for later removal.

Finally the negative, after a slight washing, is placed in an average solution of hyposulphite of soda (not an acid one —just plain hypo and water). In this the white portions of the negative are permanently removed, clearing it up and greatly improving its printing qualities. A thorough washing is then necessary.—George Parke, Chicago, Ill.

## Ventilating the Feet

Those bothered with perspiring feet will find relief in the simple kink shown in the photo. Two holes are punched in the shoe at the point shown, about 1½ in.

Two Shoelace Eyelets in Side of Shoe Prevent Excessive Perspiration of Feet

above the sole, and eyelets set in; any shoe-repair man will do this for a few cents. The holes are hardly visible when the shoes are worn so it does not detract from their appearance. The motion of the foot makes the shoe act as a bellows, drawing in and expelling air, which will keep the feet cool and prevent excessive perspiration. On cold days, a strip of adhesive tape pasted over the eyelets on the inside will make the shoe as warm as before.—R. W. McPherson, Lincoln, Nebr.

### Neat Thread Cabinet

The thread cabinet shown in the photo was made from an ordinary file box. Holes are drilled through the front to permit the threads to be pulled out. Blind holes are made in the sides for wire spindles to carry the spools. These spindles are a little longer than the inside width of the box and can be sprung into place without needing much straightening afterward. To prevent the ends of the threads from slipping back into the box, a sheet of rubber, cut from an old inner tube, is tacked to the inside surface of the front of the cabinet. Small holes are made in the rubber and the threads drawn through. If desired, a small piece

Simple Thread Cabinet Made from Old File Box

of paper can be pasted over each hole to designate the size of the threads. From 10 to 20 spools of thread can be stored in a single cabinet in this way.

¶ Small holes in cooking utensils may be filled by a common pin, or piece of copper wire, inserted in the hole, riveted, and soldered.

### Jack Fits Different Wagons

The main lever of the jack shown in the illustration is a piece of 1⅛-in. hardwood, 5 or 6 inches wide at the widest portion,

Simple Homemade Jack for the Wagon That Can Be Adjusted to Varying Axle Heights

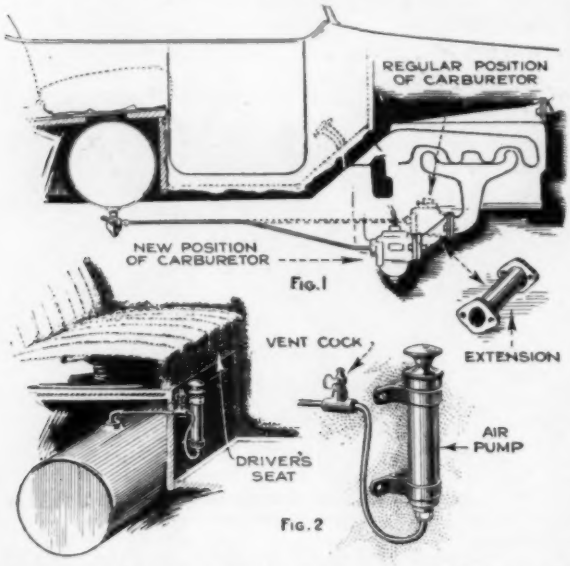
and tapering to a width of 2 in. at the handle end. It is 6 ft. long. Two legs of the same material, and a little longer than the height of the wagon axle, are bolted loosely, one on each side of the handle, 10 in. from the wide end, with a ½-in. carriage bolt. A ⅜-in. rod, 40 in. long and having a hook forged on each end, is fastened to the right leg near the bottom. A row of holes is bored in the long lever, commencing 12 in. from the smaller end and spaced 4 in. apart to within 1 ft. of the hinge bolt To use the jack, take hold of the handle with one hand and the rod with the other. Place the short end of the lever under the axle with the handle end a little above the level, and the loose leg resting on the ground back of the axle. Pull back on the rod until the other leg rests on the ground, then bear down on the handle and hook the outer end of the rod in one of the holes in the handle.

### Simple "Bug Chasers"

There are two unusual and little-known methods of preventing beetles from attacking the young cucumber vines of the backyard gardener. One is to place a nasturtium seed in each hill when the cucumbers are planted. The other is to scatter pieces of mothballs about the plants. Both of these methods have been tried, and found to do the trick as well as commercial "bug chasers."—C. M. Wilcox, Torrington, Conn.

### Making Gravity Feed Efficient

Failure of the gasoline to get into the carburetor when the car ascends a steep grade is a difficulty frequently experienced by owners of Ford cars. This trouble can be prevented to a great extent by simply lowering the carburetor from the position indicated by the dotted lines in Fig. 1 to a position about 4 in. below, and cutting, bending and fitting the tubing to correspond. Such a shift necessitates the use of an offset extension to connect the carburetor to the intake manifold, which can be made from a short length of iron pipe provided with a flange of ⅜-in. flat iron welded to each end. The extension must, of course, be fitted tightly and gaskets used where connection is made to the carburetor and manifold. If this arrangement is not desired, the same result can be accomplished by providing a small hand air pump below the front seat, and connecting this to the gas tank, as shown in Fig. 2. The most convenient location for the pump is at the right side of the driver's seat. A hole is drilled in the top of the gasoline tank and a short length of copper tubing soldered in it. A vent cock is soldered to the other end and from the vent cock another short length of tubing is run to the pump. The gasoline-tank cap is fitted with a rubber washer permitting it to be closed tightly and the small air vent is plugged with a drop of solder. The air-vent cock in the pump line is always open when the pump is not used, to permit the entrance of air into the tank. But when a steep grade has to be ascended, the vent cock is closed and air is pumped into the tank. The increased pressure will then force the gas up into the carburetor so that no more trouble will be experienced.—G. A. Luers, Washington, D. C.




**Two Simple Methods of Getting Gasoline into the Carburetor of Gravity-Feed Car When Ascending Steep Grades**

### Finishing Wood Silver-Gray

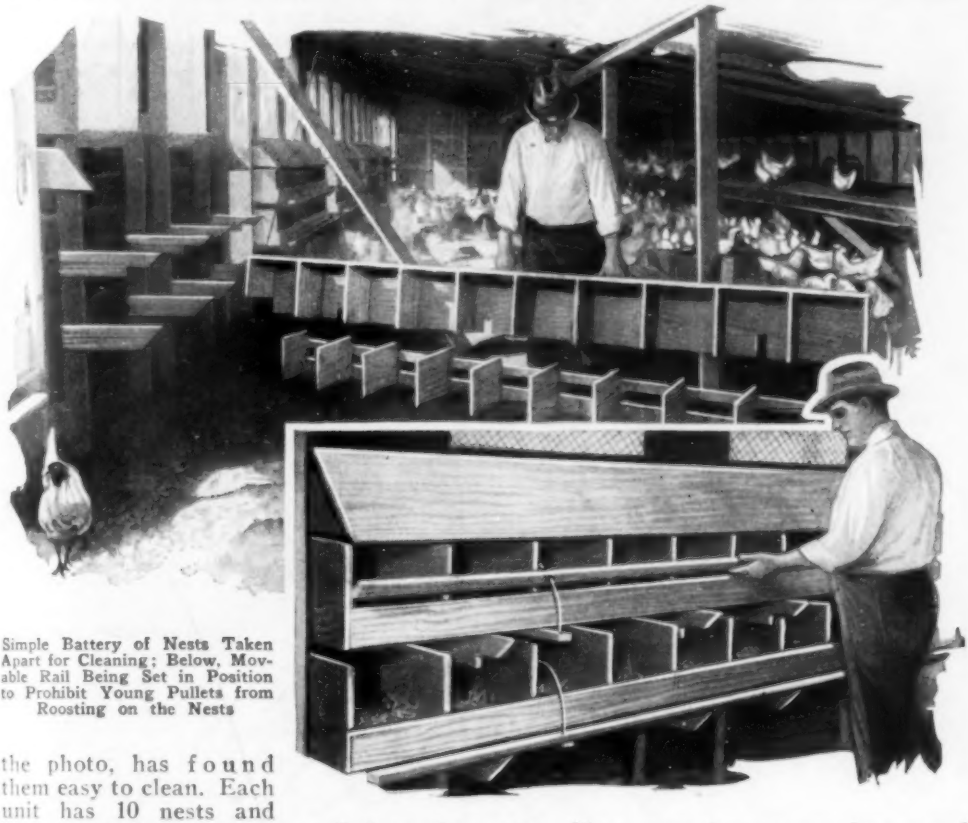
One of the easiest ways of getting a silver-gray finish on wood is to use a thin stain made as follows: Thin 5 lb. fine silica with equal parts of coach japan and turpentine, then mix with 7½ lb. white lead. Apply this to the wood and let it stand until it sets. Then, with a piece of stiff felt or leather, rub the mixture into the grain until it rolls up in small particles. Next take an old rag and rub the entire surface clean, so as to leave the filler in the grain of the wood while the surface is practically clear. The addition of a little lampblack or Prussian blue to the filler will give it a darker tint and make the grain more prominent.—A. C. Cole, Chicago, Ill.

### Safety Device on Baby Swing

Baby swings of the kind shown in the drawing are more or less dangerous as the spring may jump off the hook, which, of course, lets the child fall. This danger of accident can be eliminated by using a length of strong cord and threading it through the eyes as indicated. Now, if the spring should come off, the swing cannot fall and the spring is not likely to strike the child's head, which happened in one case, causing brain concussion and resulting in death.—F. A. Inman, Grand Haven Michigan.

### Easily Cleaned Poultry Nests

An Indiana poultry man who has arranged his nests in the manner shown in the photo, has found them easy to clean. Each unit has 10 nests and is suspended on brackets nailed to the studdings of the chicken house, as indicated. An extra rail runs along the unit to prevent young pullets from roosting on the front edge of the nests. This rail is a length of 2-in. pine, perforated so that it can be slid up and down on two guides of heavy wire. In its upper position the rail prevents the hens from roosting on the edge of the nests. After all the hens have found their proper roosting place at dusk, the rail is lowered so that fowls can get out in the morning.—J. C. Allen, West Lafayette, Ind.



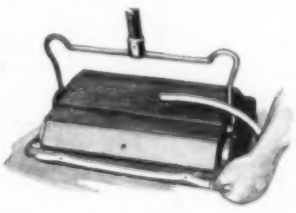
Simple Battery of Nests Taken Apart for Cleaning; Below, Movable Rail Being Set in Position to Prohibit Young Pullets from Roosting on the Nests

### Using Vacuum Cleaner as Fly Catcher

Swatting flies is effective, but it is a slow process of extermination and is to some extent a waste of time. Why not do the work effectively in a few moments? No matter how many flies have gained access to the house, just be patient and wait until evening. Then the flies get on the ceiling and remain there for the night. Get out your vacuum cleaner and attach the hose and extension tube, which will enable you to reach the ceiling with ease. Now, start the vacuum cleaner and pull in the flies, keeping the open end of the extension tube about an inch below the ceiling. In a short time you will have quite a collection of flies in the bag.

### Bumper on Carpet Sweeper

The usual strip of felt that is tacked around a carpet sweeper becomes hard in time, and often hangs in loops about the sides so that it becomes inefficient and valueless. A length of rubber tubing tacked around the sides of the sweeper will prevent marring of objects such as table and chair legs when the sweeper is used.



# How to Make a Nodding Doggie

By W. P. MOTT

THE nodding doggie is an amusing toy for small children, and is not at all difficult to construct, neither is any elaborate tool equipment necessary. As may be gathered from the illustrations, it is made in three parts, the body and the movable head and tail. Two lengths of cord are attached to the movable parts, tied together some distance below the toy and provided with a small weight at the lower end. When the body of the dog is held in the hand by means of fingergrips, and the weight on the end of the strings is allowed to swing like a pendulum the dog nods his head and wags his tail, in a manner very lifelike to the children, as shown in Figs. 1 and 2.

The parts for the toy can be cut from any easily worked soft wood. The simplest way to make the pieces is to cut them from wood of the proper thickness with a coping saw or fretsaw, but, if these are not at hand, a good job can still be done with nothing more than a pocketknife. The body is made in three parts; two like the full-line shape shown in Fig. 3 and one of the shape shown by the dotted lines and marked A, in the same figure. The three parts are then assembled as indicated in Fig. 4, so that a slot is left at each end of the body for the head and the tail. Fig. 3 details the parts laid out to scale, and if the wood to be cut into shape is laid out in ½-in. squares, the design can very readily be copied from the drawing.

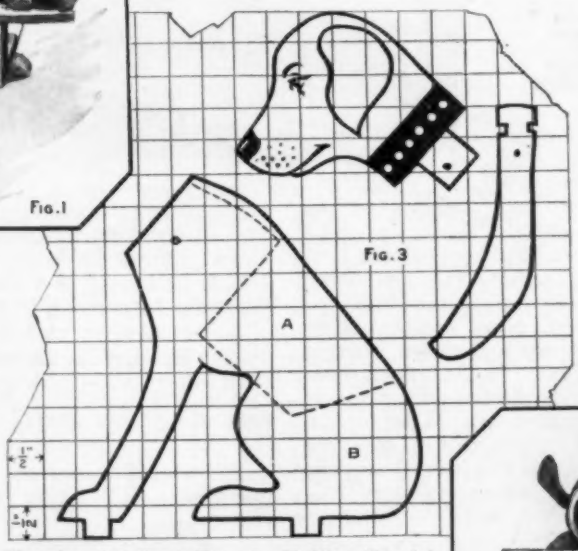


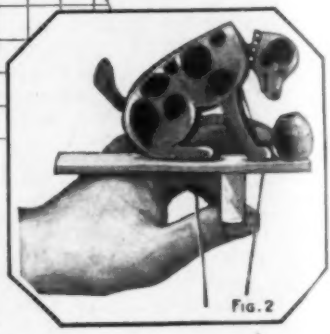

Fig. 3

Figs. 1 and 2 Show How the Nodding Doggie Works; the Center Drawing Is a Scale Layout of the Parts

The head and tail are pivoted in the body on small wire nails, care being taken to round off the corner of the body under the neck so that the head can swing downward freely when the toy is operated. When the parts have been assembled, the dog is mounted on a platform or base, 5¾ in. long, 1½ in. wide and 3/16 in. thick. Small slots are cut in this to take the small projections on the dog's feet, and the latter are then glued into the slots. The handgrip consists of two strips of 3/16-in. wood, ½ in. wide and 4 in. long, glued or nailed to a ½ by 1 by 1½-in. block, the ends of the strips and the block being joined flush, and the assembly then nailed to the underside of the platform, a little to the rear of the front feet and flush with the back.

The cords are 2 ft. 6 in. long and are passed through small holes drilled on the center line of the platform; one of these is drilled ½ in. in front of the handgrip and the other ¾ in. behind it. The method of attaching the upper ends of the cords is clearly shown in Fig. 4. The other ends of the cords are joined together and a weight of about 3 oz. hung to them.

In the original, a small nut was mounted on the front end of the platform so that the dog



Assembly of the Parts of the Nodding Doggie, Showing How the Cords Are Attached to the Head and Tail and Led through the Platform

appeared to be drinking from it, but this may be omitted if desired, or any similar device substituted for it. The coloring, too, may suit the maker. The original coloring is walnut with ears and muzzle burned to the correct hue with a hot iron. By using any of the enamel paints that are made for toys and decorative articles, an attractive toy can be made.

## Warm Up Engine as Soon as Possible Experts Advise

Experts of the bureau of standards have found that hot water in the jacket of the automobile engine helps reduce the thinning of the oil in the crankcase. In a cool cylinder, it is explained, the fuel is only partly vaporized, and the unvaporized gasoline does not burn. Instead, it remains in the cylinder and mixes with the oil, and is carried into the lubricating system of the engine. After a period of operation, the oil becomes so diluted that its lubrication value is considerably lowered, and it has to be replaced. A very small portion of gasoline suffices to produce serious dilution in the crankcase. Everything possible should be done to warm up the engine quickly when starting, as dilution has been found to take place much more rapidly when starting than when the engine has reached its normal operating temperature. In fact, the consumption of gasoline when starting may be as much as twenty times the normal rate, and much of the unburned gasoline gets into the oil. Dilution is also made worse by frequent stopping and starting of the engine, with alternate short periods of warming up and cooling off. Dilution may also be lessened by high temperature of the crankcase oil, as heat tends to separate the gasoline from the oil.

### Improvised Typewriter Desk

When traveling, improvised methods of typewriting must often be devised. One salesman obtained a light, strong board,

Salesman's Method of Improvising a Desk on His Wardrobe Trunk

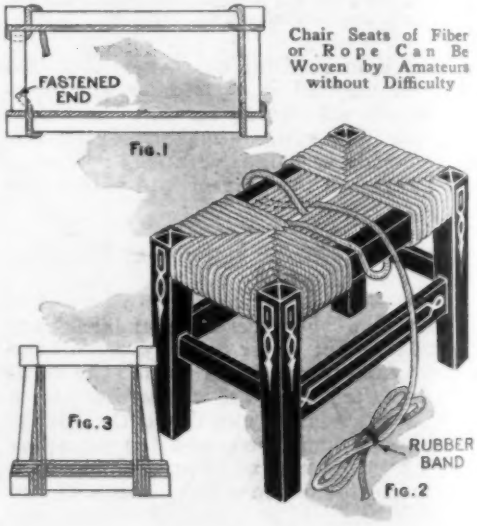
which fitted in his wardrobe trunk. When he desires a desk, the board is simply strapped on one section of the trunk and its front edge is supported with an iron-rod brace, as shown in the photograph. This rod is slipped through the pulls of the lower drawers and the upper end fits snugly in a hole drilled in the board.—P. C. Grose, McComb, Ohio.

### Making Woven Chair Seats

There is an almost unlimited variety of materials that can be used for making woven chair seats. Rushes have been used, but they present certain difficulties, and considerable skill is required to join the leaves together to make a good job, so that this method is not advisable for the amateur. Two other materials, much easier to manipulate and to obtain, are fiber, which is merely strong paper twisted into a strand, and rope. There are three types of chair seats; square, rectangular and irregular. The first two are the easiest to weave and the last one presents only the slight difficulty of filling up the irregular spaces in the front corners. This, however, is easily learned after a few attempts.

The fiber or rope should first be dipped in water. In the case of fiber this means that it should be merely moistened, while the rope may be soaked without harm. The moistening will cause the material to contract somewhat upon drying so that the finished seat will be tighter and better-appearing. Fig. 1 shows how the work of weaving a rectangular seat is begun. The loose end is tacked inside of one of the end rails, and the strand is then brought over and under the front rail, around the end rail and across to the opposite rail. This operation is repeated at each corner until the seat is completed. If the seat is square, the strands will meet in the center, but in a rectangular seat the end rails will be filled up before the side rails, and an open space will be left at the center as shown in Fig. 2, which must be filled up in some manner. This is done by bringing the strand over and under the sides through the center as shown. As the weaving progresses the seat is stuffed. This may be done with tough brown paper or newspaper, which is crumpled up and tightly packed into the seat with a curved stick. The most convenient method of doing the work is to cut off a long piece of the fiber or rope and hold it together with a rubber band. If it is necessary to joint two pieces, make the knot at some point where it will not show on top.

An irregular seat of the style most commonly seen is shown in Fig. 3. The first thing to do is to fill in the seat until the center is a perfect square. This is done by tacking the ends to the inside of the



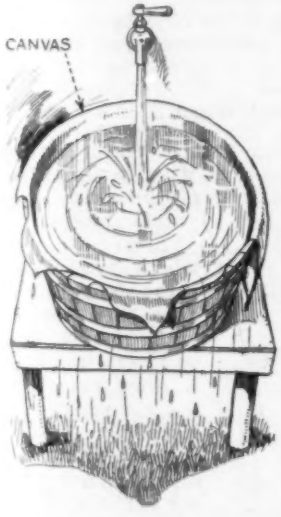

Chair Seats of Fiber or Rope Can Be Woven by Amateurs without Difficulty

side rails, both ends of the strand being thus fastened. It will be noted that the operation of filling in the corners cannot be continuous. However, after the cor-

ners have been filled out, the weaving is done in the same way as described above, by starting to work from one of the corners at the back. After the work is done, the loose end of the material can be either tacked to the chair rails or inserted between strands and given one or two twists. The finishing touch is given by applying a coat of paint or other finish. This is usually necessary in the case of fiber, to prevent it from fluffing up and assuming a furry appearance after some use, and also to protect it against the weakening effect of moisture. In most cases the most pleasing effect is obtained by the use of green stain followed with a coat of shellac.

## Making Large Shrunken Tubs and Tanks of Wood Water-Tight

A small wooden tub had shrunk so much that the hoops did not hold the staves together, and would not hold water more than a few inches above the bottom. No larger container in which the tub could be submerged was at hand, and so the following method was adopted: The tub was placed under a water faucet and a piece of canvas laid inside. A gentle stream of water was allowed to run into the tub, and it was found possible to fill the tub right up to the top, as the canvas sheet stopped the leaking almost completely. Once the tub was filled, the faucet was turned down so that only enough water ran into the tub to make up for leakage. Soon the staves had swelled to normal size, and the canvas sheet was removed. By using a piece of canvas large enough to overlap the edge of the tub, the process of swelling will be greatly hastened. This method is of particular value in case of tanks that are too large to be placed into a still larger vessel, or cannot be removed for this purpose.—C. A. Oldroyd, Barrow-in-Furness, Eng.




## Easily Built Clothes-Drying Cabinet Fits over Radiator

In any house having steam or hot-water heat, a clothes drier, built over a radiator,

Household Clothes Drier Built over Steam or Hot-Water Radiator

will be found convenient. It is made of ¾-in. lumber, and a neat job can be done without difficulty by a fairly experienced amateur. The bottom of the cabinet over the radiator is open, but the other parts are solid except that the top is perforated with a number of holes to let out the damp air. Round sticks are fitted inside to hang the washed articles on.—R. W. Watson, Yonkers, N. Y.

## Doubling Life of Eraser

Don't throw away that typewriter eraser merely because it has been worn down to the circular metal support at the center; just about half of the eraser remains, and it can be used almost down to the last particle. Take a strong letter opener, or the blade of a pair of shears, and bend back the metal on each side of the rubber until it stands out at right angles at one part of the circumference. This leaves the rubber free for use, and the upturned metal serves as a support for the fingers, making the eraser actually easier to use than when originally purchased.—P. F. Wall, Chicago, Ill.

### Auto Drives Corn Sheller

Driving a corn sheller from the rear wheel of an auto by friction is about the simplest method that can be devised, as

Corn Sheller Run from Rear Wheel of Auto by Friction

it dispenses with a belt or any kind of a coupling unit. The corn sheller is set at right angles to the rear wheel of the auto so that the flywheel touches the tire. Plenty of power is provided in this way.

### Handling Lighting Current Safely

While the transformer and rectifier have made it possible to use lighting current instead of batteries for the amateur's purposes, some of these, particularly the younger ones, are likely to forget that a current of 110 to 220 volts is not quite the harmless power that batteries supply. Short circuits and faulty installation generally not only are sources of danger to the home, but may interrupt the service of the whole neighborhood.

The wiring must be run in accordance with the regulations of the national board of fire underwriters, which specify that no wire smaller than No. 14 shall be used; that this must be properly insulated and spaced; equipped with approved fittings, and have joints soldered. Every amateur should acquaint himself thoroughly with these regulations before attempting to wire his laboratory, for, if fire develops from any cause traceable to electric wiring, and these regulations have not been followed, there may be difficulty in collecting insurance claims.

The laboratory tap should be taken off the supply mains at some point between the service switch and the distribution panel, thus making the laboratory circuit a branch circuit in itself. Then, if a short occurs, lights will not be affected provided the fuses are of the proper size. Of equal importance is the type of outlet used for connecting transformers.

The safest, simplest, and at the same time one of the most inexpensive forms of outlet, is a standard safety switch controlling a standard outlet box. It is inclosed in a steel box, fitted with fuses, and is so constructed that no current-carrying part can be touched while "live." The outlet is the kind used for connecting grills, toasters, and other household devices, and will receive any standard separable plug.

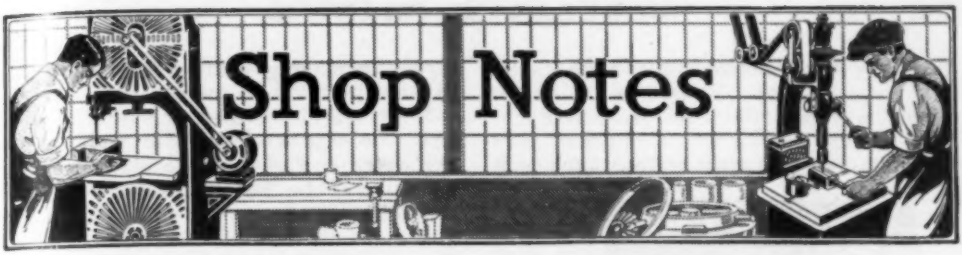
Fuses should be smaller than those in the service switch, say 6 to 10 amperes, if the latter are 15 or 20. Then, on a short, the laboratory fuses will blow without disturbing those controlling the entire house.

When using a chemical rectifier, it is always advisable to have the jars boxed in, or otherwise inclosed, so that wire, tools, or other metallic objects falling on the jar tops will not cause short circuits.

### Renewing Worn Shirts

Shirts often wear out or tear near the neckband and are then usually discarded, even though the rest of the shirt is in good condition. A simple repair, which makes it possible to renew the shirt without any sign of alteration, if it is done carefully, is shown in the illustration. The sleeves are removed and the top of the front of the shirt and a portion under each sleeve are cut away as indicated by the dotted lines. The neckband is then replaced and the sleeves sewed on again. The repair, if undertaken in time, need not shorten the front more than an inch or so.—F. E. Walker, Atlanta, Ga.

¶Discarded phonograph needles make excellent glazier's points; they are driven into the sash in the usual way, before the putty is applied.

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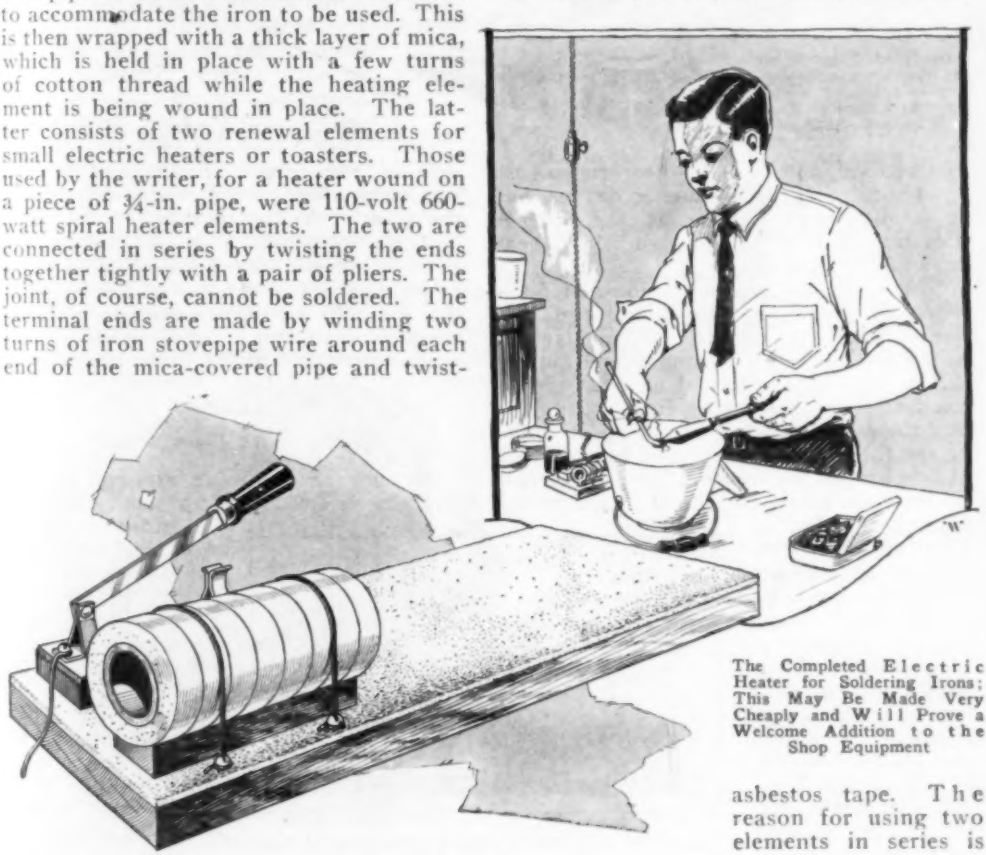
# Making a Soldering-Iron Heater

By C. H. STARR

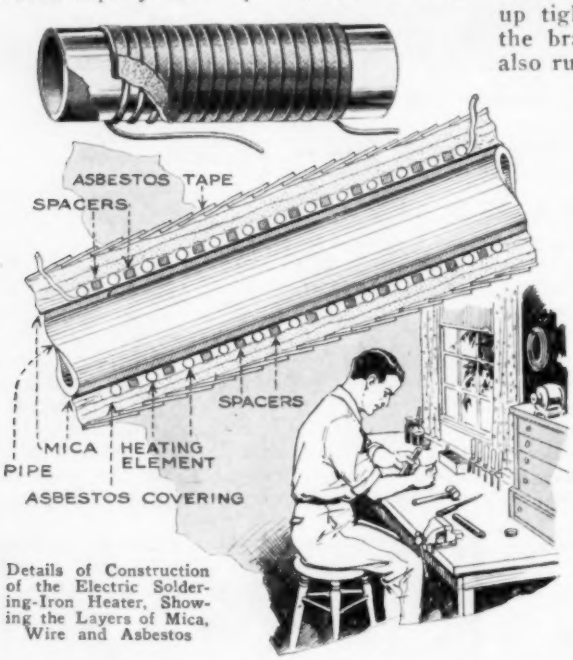
AN arrangement that possesses many of the advantages of the electric soldering iron, but can be constructed at a fraction of its price, is shown in the accompanying illustrations. There are many cases where the cost of the electric tool is too high for the small-shop tinkerer, and this attachment will take its place with very little loss in efficiency.

The first thing to obtain is a piece of iron pipe of an internal diameter sufficient to accommodate the iron to be used. This is then wrapped with a thick layer of mica, which is held in place with a few turns of cotton thread while the heating element is being wound in place. The latter consists of two renewal elements for small electric heaters or toasters. Those used by the writer, for a heater wound on a piece of ¾-in. pipe, were 110-volt 660-watt spiral heater elements. The two are connected in series by twisting the ends together tightly with a pair of pliers. The joint, of course, cannot be soldered. The terminal ends are made by winding two turns of iron stovepipe wire around each end of the mica-covered pipe and twisting each end of the element and the two ends of each stovepipe wire together tightly. A length of asbestos tape, or a narrow strip of asbestos cut from a sheet, is wound between the turns of the element to serve as spacers, preventing the turns from touching each other accidentally, and thus short-circuiting part of the winding. A thick outer layer of asbestos is then wound or wrapped over the element and held in place by a winding of wire or asbestos tape. The reason for using two elements in series is



The Completed Electric Heater for Soldering Irons; This May Be Made Very Cheaply and Will Prove a Welcome Addition to the Shop Equipment

that they are designed to operate singly in the open air, and, if used in the heater tightly wrapped in asbestos, where the heat cannot be carried off quickly, they would rapidly burn up. Resistance wire




Details of Construction of the Electric Soldering-Iron Heater, Showing the Layers of Mica, Wire and Asbestos

can be used instead of the heater elements for the winding, if the maker desires, but it is difficult to arrive at the correct amount of wire to give sufficient heat without burning up.

The complete heater is mounted on a piece of board of convenient size, the board being first covered with a layer of asbestos sheeting. A single-pole single-throw switch is mounted at one side of the heater, on the board, for shutting off and throwing on the current, and a holder for the soldering iron can be mounted at one end of the board. The heater can be fastened down, as shown in the drawings, by means of wire passed over the top and caught under the heads of round-head wood screws driven into the board. It is advisable to put some strips of sheet asbestos between the heater and the baseboard. The whole outfit can then be painted with water glass.

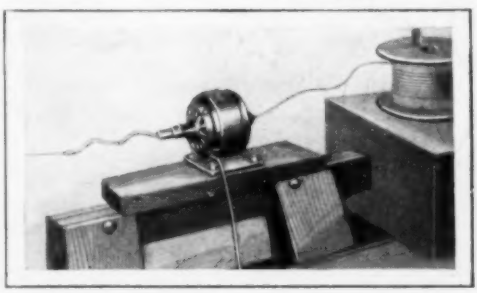
## Remedying Worn Ford Hubs

Ford rear hubs and axle shafts sometimes become worn so that if the nut on the outer end of the axle shaft is drawn up tightly, the hub bolts will strike on the brake-shoe support bolt. They will also rub on the brake-shoe springs, causing a squeak much like a loose rim. Often the brake shoe will drag by rubbing with the outer edge on the brake drum when released.

As an alternative to replacing the hub or using a sheet-iron shim on the axle, the brake-shoe bolt can be removed and the head filed down thin. If the brake shoe drags, the outer edge can be filed or ground off slightly. Another plan, which is better than either of the above, is to remove the hub bolts and replace them with the heads inside the brake drum. As they are special carriage bolts with a short square part under the head, the holes in the brake drum must be either countersunk or squared by filing or with a drift. Because of the shortness of the squared part, only the drum need be changed. This leaves the nuts on the outside of the wheel, where they can be tightened when needed without removing the wheel. As the rounded heads of the bolts do not project so much as a nut and riveted bolt end, there will be more room inside the brake drum. A drawback is that the bolts would be harder to break off in case of anything jamming within the brake drum, and might cause more strain on the axle housings.

## Novel Wire Straightener

We use an immense amount of fine spring wire for making a small clip used in radio construction, and unless the coil is taken out before making it into clips, it gives all kinds of trouble. The common type of straightening rolls did not appeal to us, so we took a small 1/16-hp. electric motor, which we had on hand, drilled a hole



Taking the Coil Out of Spring Wire with a Small Motor and a Bent Tube

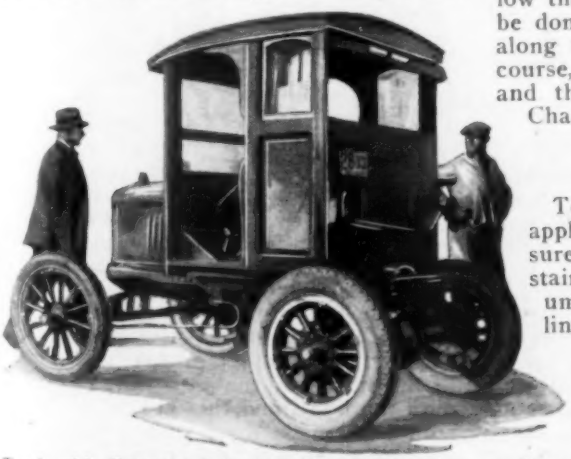
straight through the shaft lengthwise and attached a wavy tube to one end with a small collar and setscrew, as shown in the photo. The wire is taken direct from the spool, threaded through the hole in the spindle and the tube, and then into the clip-making machine. An automatic switch and cutout is used between the clip machine and the straightener so that the motor only runs when the clip machine does.—A. E. Granville, Cincinnati, Ohio.

### A Brass Drift Block on Drill Press

When using small drills with tapered shanks in the drill press, it is necessary to use sleeves to build up the shank to the size of the hole in the press spindle. Generally these sleeves are slipped on the drill and then, by taking the drill in one hand, it is struck against the vise, bench anvil or other piece of iron. This keeps the tang of the sleeve all battered up and continually causes trouble when inserting the drill and sleeve in the spindle. The trouble can be overcome by fastening a soft brass block in a convenient place on the drill press and tapping the sleeves on this. The tang of the sleeve should strike the brass block.

### Short Truck Makes Sharp Turns

On narrow piers, the short truck shown in the photo, has been found to be of great use, as its size enables it to turn around in a very small space. It is just an ordinary truck having the driveshaft shortened so that it measures only 6 ft. from hub to hub. The rear end is fitted so as to make a quick hook-up to a trailer possible.—W. M. Strong, Providence, R. I.



Truck with Shortened Driveshaft Makes Sharp Turns on Piers

### Cutting Pipe at Angles

Cutting pipe accurately at an angle with a hacksaw is no easy job, as it is difficult to scribe a line on the pipe. However, by using the rig shown in the drawing, a clear mark can be made.

Time-Saving Method of Marking Pipe for Cutting at an Angle

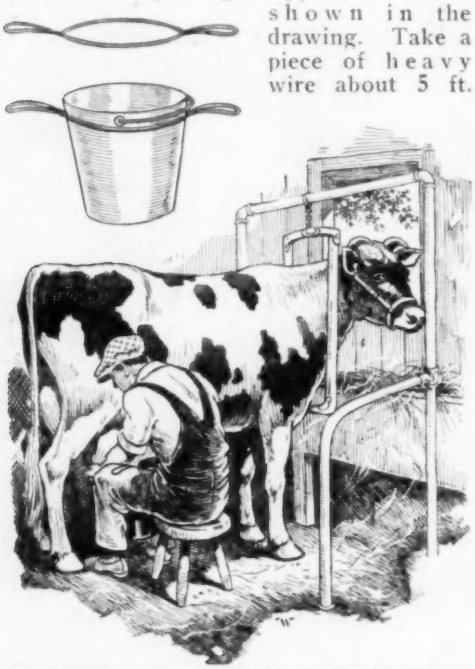
All that is necessary is a stand with an adjustable top to hold the pipe at the desired angle, and a can of white paint into which the end of the pipe is dipped. The stand is readily knocked together in a few minutes. The top is hinged onto the vertical part and two slats are tacked on to hold it at the proper angle. The drawing clearly shows how the rig is used. After dipping, the pipe is set away to allow the paint to dry, or if the job must be done at once, a mark can be scribed along the edge of the paint. It is, of course, necessary to have both the stand and the paint pot on a level floor.—Charles Kugler, Philadelphia, Pa.

### Walnut Stain for Cypress

To finish cypress like walnut, first apply a very thin coat of shellac to insure an even foundation. Then use a stain made as follows: 2 lb. burnt umber, 1 lb. raw umber, 2 qt. boiled linseed oil, 1 qt. best brown japan, and 2 qt. turpentine. First break up the oil color with japan, then add the oil and last the turpentine. Test the stain on new wood and vary the amount of thinner to obtain the desired color.

### Milk-Bucket Support Holds Pail Conveniently

Holding a milking pail can be made much easier by using a support of the kind shown in the drawing. Take a piece of heavy wire about 5 ft. long, bring the ends together and splice them. It is better to solder the joint so that the wire ends will not catch and tear the clothes. Set the milk pail inside of this loop, and twist the wire on each side near the top of the bucket to form two small handles of equal size. Give these handles a slight curve so that they will fit over the knees securely and at the same time comfortably.—Harold Pinkerton, Pawnee City, Nebr.



Simple Support for the Milking Pail Holds It Conveniently on the Knees

### Taking Up Play in Brass Bushings

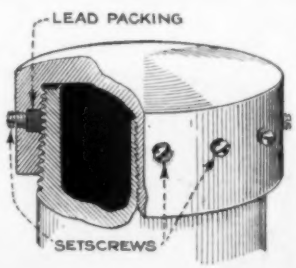
It is often necessary to take up the play in brass bushings such as used in all kinds of electric motors, gas-engine pistons, etc. It is customary to remove the old bushing and press a new one in place, and then ream it to fit the shaft that goes through it, but it is often necessary to replace such a bushing when there is no new one on hand. In such cases, an effective repair can be made by pressing the old bushing out and applying a thin coat of solder all around its outside, then round the edges of the hole slightly where the bushing is to be pressed in. Press the bushing back in place and, with an adjustable reamer, ream it out to fit the shaft. A repair of this kind has always proved just as good as a new bushing and has saved many delays.—Ed Sundholm, Albert City, Iowa.

### Removing Stains Caused by Fire

Stains on brickwork from fire and other causes can be removed with the following mixture: Take 1 gal. soft soap, 2 lb. fine powdered pumice and 1 pt. liquid ammonia. Mix thoroughly. Brush the surface of the bricks to remove the loose soot and dirt and then apply the mixture with a fiber wall brush or a whitewash brush. Allow it to remain on the wall for twenty or thirty minutes, then rub it briskly with a good scrubbing brush, dipping the brush occasionally in clean water.—A. C. Cole, Chicago, Ill.

### Lead for High-Pressure Packing

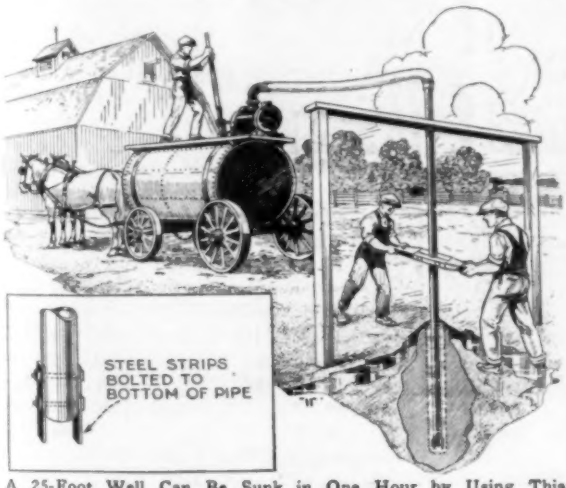
In the shop it is sometimes necessary to devise containers, which will stand pressures in excess of 3,000 lb. per square in. Seamless containers, which are used for hydrogen, oxygen and other gases, will be tight under such high pressures without leakage. For shop purposes, however, the container must invariably be made up of pipe and fittings, or stock that can readily be machined. Welded joints in high-pressure containers are not entirely dependable because of the lack of uniform strength in the welded joint, and the possibility of error due to workmanship. A problem of holding a 4,000-lb. pressure progressed through various stages of experimenting. The most commonly used method of making a tight joint by tinning the parts and sweating them together failed entirely, presumably due to the expansion of the parts when they were subjected to pressure. The final solution, which is shown in the illustration, was found in the use of lead packing. A circular groove was turned in the inside of the cap, which screwed onto the body, and this groove was filled with lead, made tight with a number of packing screws, driven from the outside. With this seal all leakage can be elimi-



nated. It is not necessary to use a single length of lead for this joint as lead pellets under the screws will serve the purpose just as well, these being forced together under the pressure of the screws. More lead can always be added if leaks develop. Besides the simplicity of this form of packing, which makes it extremely useful, it has the advantage of being readily disassembled when this becomes necessary as is frequently the case.—G. A. Luers, Washington, D. C.

### Quick Well-Drilling Method

A well can be quickly drilled as shown in the drawing if the soil is not too rocky or sandy. The work is done by three men. One pumps the water and two manipulate the pipe. The pipe should be churned up and down and twisted to agitate the dirt at the bottom of the hole and to mix it with the water, so that the dirt will be washed up out of the hole. As the hole deepens, more pipe is added at the top, and, if desired, the pipe can be left in the hole when completed. This method cannot be used successfully where strata of gravel are encountered unless one has some other means of getting through the gravel. The writer used this method to sink a well 25 ft. deep and the whole operation of drilling consumed only about one hour after spudding in. —Ed. Wetzel, Union, Oreg.



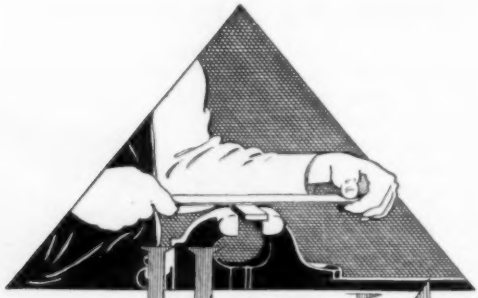

A 25-Foot Well Can Be Sunk in One Hour by Using This Method of Drilling

Conveyor Carries Plaster to Floors of Building to the Plasterers in Three Minutes

### Plaster Conveyor Saves Time

In finishing a large building, the contractor saved much time and labor by rigging up the conveyor shown in the illustration, which delivered the plaster to the three stories directly on the worker's mortar boards in about three minutes. The sand, gypsum and water are mixed in a rotary concrete mixer and discharged onto a 16-in. rubber belt set at an angle of 45°, the speed of the belt being so regulated that the plaster cannot slip back. At the discharge-end a taut wire scrapes the material from the belt into a small car which is pushed around on a narrow-gauge track to the mechanics. As each is reached the material is shoveled onto his mortar board as required.

¶Where exceedingly accurate, smooth holes are required, there is no better tool to produce them than a properly made carbon-steel hand reamer, and if the work must be done in a chucking machine, a carbon-steel chucking reamer. This is particularly true of brass.

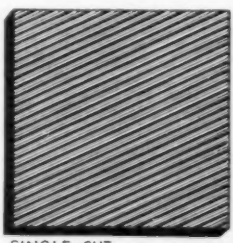


# Files and How to Use Them

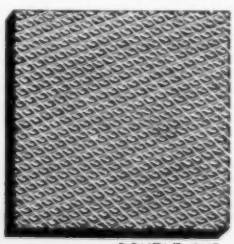
## A Popular Mechanics Model Workshop Article

Part I

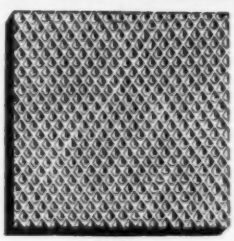
THE file, like the chisel, is one of the oldest of mechanics' tools. Not even the machine tool has supplanted the file, although, of course, the machinist is no longer dependent upon the file alone for producing flat, true surfaces on metal. The word true is used in a comparative sense, of course, although the mechanic who has mastered the use of the file can produce a remarkably true surface with it. The machine tools, such as the planer, shaper and surface grinder, have taken the place of the file and scraper for making broad metal surfaces flat and true, but for other purposes, the file still retains all its original usefulness. In the jobbing shop especially, the file is the indispensable tool, and facility in its use should be an aim of every budding mechanic. Once learned, the art is never forgotten. To the uninitiated, it might seem that "anybody can use a file"; this is true, but comparatively few can use a file properly and effectively.



SINGLE-CUT



DOUBLE-CUT



RASP

Fig. 1

A knowledge of the various types of files and their uses is necessary before we go on with any discussion of how to use them. There is a wide variety of shapes and sizes of files and a number of different "cuts" for each shape. Many of the shapes are used but seldom in the machine shop, but the mechanic should know something of them all.

Files are classified not only according to their shape, but also according to the cut, and there are three general cuts in common use, the single cut, double cut and rasp. The single-cut file has single rows of teeth cut parallel across its faces at an angle of from 65 to 85°, depending on the form of the tool and the work for which it is intended. The double-cut file has two rows of teeth cut on each face crossing each other; the angle of the first row (the "over" cut) is from 40 to 45° for general work, and the angle of the second (the "up" cut) from 70 to 80°. This is changed in files intended for finishing work to 30° for the over cut and around 85° for the up cut. The latter is generally slightly finer and not quite so deep as the over cut. The tooth formed by the double cutting is broken in shape, and the cutting face of the file presents a number of small pointed teeth, inclining forward. Fig. 1 shows the difference

between a single-cut and a double-cut file and also the third cut, the rasp. The teeth of this file are formed by a punch instead of by a chisel, consequently they are disconnected and do not extend across the file like the others.

The spacing of the teeth forms a further division of single and double-cut files. The names of the different grades, ranging in order of their spacing, are as follows: rough, coarse, bastard, second-cut and smooth for single-cut files; and coarse, bastard, second-cut, smooth and dead-smooth for double-cut files (see Fig. 2). It will be noted that the rough files are usually single-cut and the dead-smooth double-cut. As the length of the file increases, the number of teeth per inch decreases, so these grades can only be compared in files of the same length. There is a wide variation in the number of teeth per inch of length in files made by different makers, but a fair average is as follows: bastard, from 20 to 25 teeth per inch; second-cut, from 30 to 40; smooth, from 50 to 60; dead-smooth, up to 80 per inch. Fine Swiss files and "American Swiss" run from about 40 to 200 teeth per inch. There are a number of other definitions that the machinist should be familiar with, among them the following; see Fig. 3: The length of a file means the distance from the heel to the point, and does not include the tang. The heel is the portion next to the handle. The back is the convex side of a half-round or similar file, and a file is termed bellied when it has a fullness in its center. A file is safe-edged when it has no teeth cut on one surface, so that this side may be presented safely to a surface that does not need filing. A file whose sides are thinner at the point than at the middle is called tapering or tapered, and it is full-tapered when it is thinner at the point and heel than at the middle. A blunt file is one that has the same sectional shape from heel to point.

Figure 4 shows a number of the most common shapes of files used in the shop. The hand file is the one generally used by machinists for finishing flat surfaces. It is tapered in thickness from the middle to the point, but parallel from the middle to the heel. The edges are generally parallel from point to heel. It is usually double-cut, and comes in bastard, second-cut, smooth and dead-smooth grades. Flat files are parallel both in thickness and width from heel to middle and tapered in both sections from middle to point. The teeth may be either single or double-cut, and of the same grade of cut as the hand file. It is one of the most useful files in the shop and is used for a wide variety of work. For lathe work, many mechanics prefer the mill file, which is parallel in thickness from heel to point, and tapered in width from middle to point. It is extensively used for draw-filing and is also used for sharpening mill saws, in which case a round-edge file is generally used to file the gullets of the saw.

Another very useful file is the pillar file, which is like the hand file, but nar-

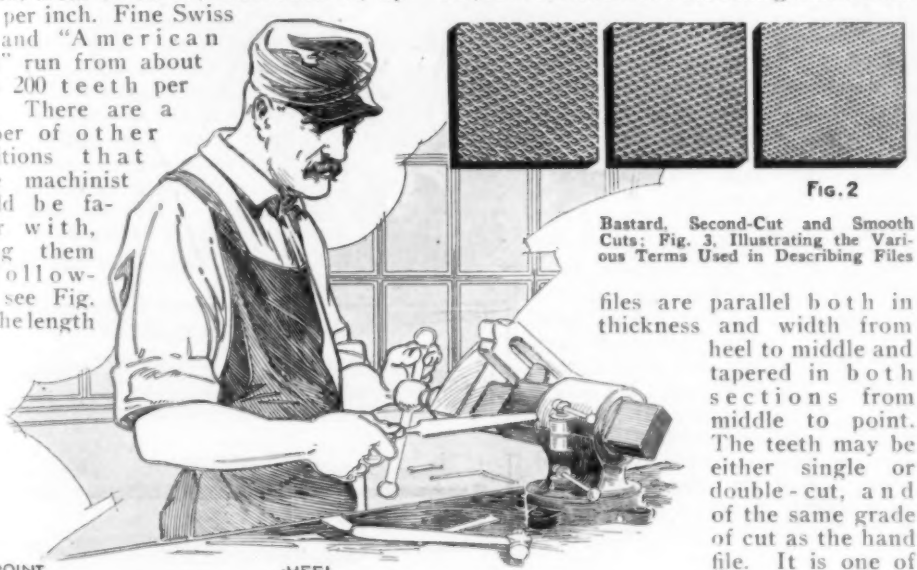


FIG. 2

Bastard, Second-Cut and Smooth Cuts; Fig. 3, Illustrating the Various Terms Used in Describing Files

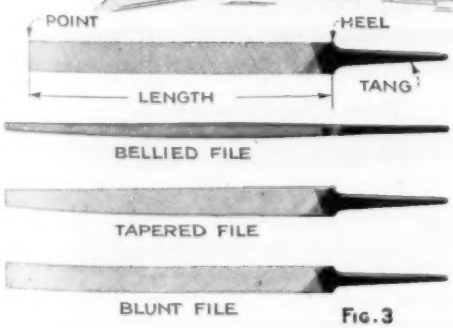



FIG. 3

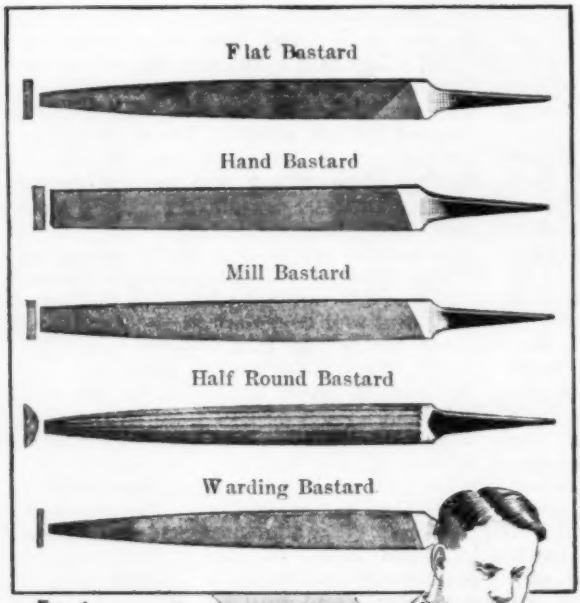


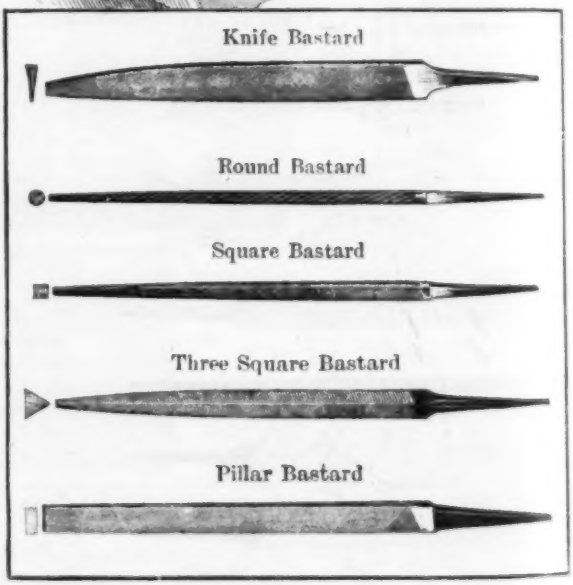

FIG. 4

A Number of the Most Commonly Used Shapes of Files, the Bastard Cut Being Generally Used

rower and shorter. The double-cut bastard is the one most generally used. Round files are made both tapered and blunt, the bastard cut being favored for slotting, enlarging round holes, filing fillets, etc.; slim round or rat-tail files are of regular length but are smaller in diameter. Square files are also made either taper or blunt, and are principally used for enlarging square slots and holes, filing keyways, and work of a similar nature. Both forms have usually bastard double-cut teeth.

The half-round file—a favorite in the shop—is not really half-round in section, but only about one-third of the circle. The commonest file of this class is double-cut and bastard, but second-cut and smooth half-round files are also generally used in the shop. The convex side of files of finer cut than the bastard is single cut. This file is extensively used for finishing curved surfaces, such as fillets that are of greater radius than can be filed with a round file, for enlarging holes, relieving the lips of brasses, etc. Warding files, as their name indicates, are used by locksmiths for filing the wards of keys, but they are also used in the machine shop to a large extent. They are of the same thickness from heel to point, but considerably tapered in width from the middle to the point. The file generally used in the shop is double-cut, bastard and smooth. The knife file also has a name that indicates its form as it is shaped somewhat like the blade of a knife. It tapers toward the point and also toward one edge. The cuts used are the same as those of the warding file.

The three-square or triangular file has three sides of equal width, and is made in the taper, blunt and slim forms. They are usually double-cut, bastard, and are useful for filing angular surfaces of many kinds. The angle of the sides is 60 degrees. There are many other shapes of files, such as the pit-saw, the tumbler, the handsaw, the featheredge, and the cabinet, but as these are but little used in the machine shop, they will not be



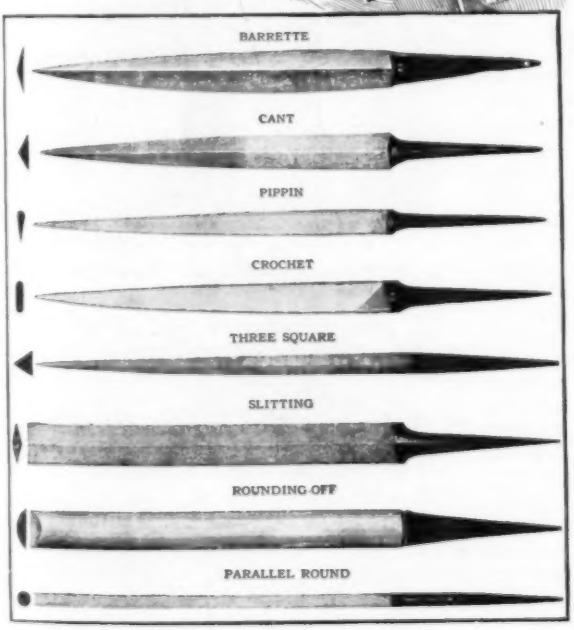
considered here. Those who wish to study the subject of files further will find all the information they require in the literature of the file manufacturers.

However, there is another class of files that are generally used in the shop by the toolmaker, and, as these files are also of use to the machinist, they are illustrated in Fig. 5. These are known as files of precision or toolmakers' files, and range in length from about 2 to 12 in. The range of cuts is from about bastard to super-smooth, and then there are cuts beyond super-smooth that have no equivalent in the ordinary machinists' file. The cuts in toolmakers' files are numbered, and the numbers run from No. 000, which corresponds approximately to a rough-cut, to No. 8. Number 2 is about the same as super-smooth, and the numbers from 3 to 8, as previously mentioned, have no equivalent in the ordinary file.

Fig. 5

Toolmakers' Files or Files of Precision; These Are the Shapes Most Used in the Shop

Figure 6 illustrates a file of entirely different characteristics from all the others previously described, the circular-cut file. This is the Vernaz file, named after the inventor, and known in the United States as the vixen file. It is also known in some shops in England and Ireland as a milling file, from the resemblance of the teeth to those of a milling cutter. As may be seen from the illustration, the teeth are milled from the solid metal, instead of being raised from the surface of the file by the action of a chisel, as in the usual process of file cutting. The teeth being curved make the cut a shearing one, and it is found that the edges cut well whether the file is driven straight or at an angle. The file is also self-clearing, and produces very smooth surfaces, as it does not "pin" or retain small particles of the metal being cut between the teeth, thus scratching the surface. On wrought iron, mild steel and similar fibrous metals this file is considered much better than the common form.



The proper method of using files for work of various kinds will be described

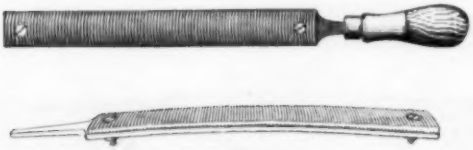


Fig. 6

**The Vixen File, Which Has Teeth of Entirely Different Shape from the Ordinary**

in the second part of this article, which will appear in a succeeding issue.

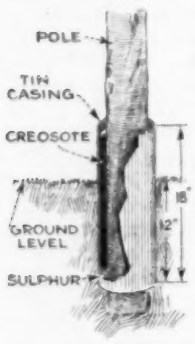
## Method of Removing and Preventing Scratch Marks from Matches

There are many places where it is very hard to remove as well as prevent match-scratch marks. The following method has been worked out, and is so successful it is well worth knowing.

To remove the scratch marks the only substance that will really clean up the woodwork is soap and the application of a stiff nailbrush. But the method of preventing these bothersome marks is simple and very effective. Obtain a small quantity of albolene and rub the woodwork well with it, then remove surplus with a flannel rag. You can scratch all day and no marks will result, neither will the match light.

## Creosoting Poles Set in Ground

A telegraph company has developed a method of creosoting telegraph poles that are already set in the ground, to prevent rotting at the ground level, where decay usually begins. A hole, about 1 ft. deep, is dug around the pole and in this a cylinder of sheet metal is set, leaving about an inch clearance between the pole and cylinder. The edges of the sheet metal are soldered together and melted sulphur is poured in between the cylinder and the pole and allowed to solidify in order to form a waterproof bottom, about 1 in. in thickness. In pouring the sulphur care is taken to avoid coating the wood, which would defeat the purpose. The container thus formed is then filled with creosote. The hole outside of the tin casing is filled up again. The creosote will gradually penetrate the wood up to a distance of about 2 ft. above and below the ground line. In this way the pole is protected nearly as well as if it had been impregnated at the butt in the regular way before it was set in the ground.




## Double-Purpose Counter Aids Toolroom Storekeeper

The drawing shows an improved storeroom counter over which tools and materials are passed to the shop. Half of the counter is flat and the other half is made to form a box. Constructed in this way, any kind of material can be handled conveniently. Some parts are best handled by sliding them over the counter, while other pieces that might roll off are more safely handled by placing them in the box. The counter is hinged at one end so that the doorway can be used for the passage of trucks when necessary. Steel plate, about 3/16 in. thick, is the material used in making the counter.—Harry Moore, Montreal, Can.

**Shop Storeroom Counter Found More Useful Than Ordinary Counter**

¶The use of shale, slate, soft limestone, and any other material that crumbles, slivers, or peels off should be avoided as an aggregate in concrete.

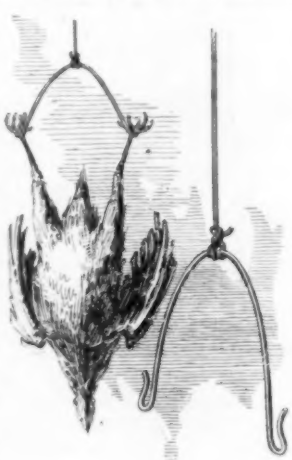
### Pipe Cleaner for Inaccessible Parts of Typewriter

The usual cleaning brushes for typewriters are often too thick and bulky to reach into the corners of the mechanism and between parts placed close together, such as the type guide in front of the ribbon and the shuttle through which the ribbon passes. A pipe cleaner of the brush type makes an excellent cleaner for these. It is inserted from the top between the parts to be cleaned, and when withdrawn, it will carry away the dirt lodged there. Care must be taken, however, that the cleaner does not become wedged by pulling it out with too much force.

For cleaning similar small mechanisms, such as clocks, electric motors of fractional horsepower, etc., the pipe cleaner will also be found invaluable. If the parts are spaced too far apart to be effectively wiped with the cleaner inserted in the usual way, it may be doubled up so that it provides a surface of twice the former width. For oiling inaccessible parts, too, the cleaner is very useful, principally on account of its length. It is dipped into the oil bottle for about ½ in.; the material forming the brush of the cleaner will then absorb sufficient oil to lubricate several small bearings. A new cleaner should be used every time a mechanism is oiled.

### Hook for Suspending Fowl

If one has many chickens or squabs to kill and pluck, the device shown in the illustration will save both time and labor. It consists of a piece of heavy galvanized iron wire, bent to the shape shown, the ends being bent over to form hooks. The device is hung from the ceiling by means of a cord. In use, the legs of the fowl are slipped into the hooks, holding the bird in a convenient position for plucking. This method of suspension is better than the use of a rope with a slip noose.



### Simple Tool for Examining Tires before Vulcanizing

When a tire is taken to a vulcanizing shop for repairs, the workman makes a thorough examination of the inside to determine the condition of the fabric. With heavy tires this inspection involves the use of blocks to hold the stiff beads apart, but this can be done much more easily by means of the tool shown in the illustration. It consists of a ⅜-in. iron rod, doubled in the middle and twisted and bent to the shape indicated. Two 1½ by 6-in. wooden rollers are mounted on the ends, and held in place by means of washers and cotter pins. The tool is easily inserted between the beads and is then given a quarter turn so that the rollers spread the beads. By pressing down on the tool and rolling the tire back and forth, the inside is easily examined.—G. E. Hendrickson, Argyle, Wis.

Twisted Iron-Rod Tool with Wooden Rollers Enables Tire Man to Make Thorough Examination of Fabric

### Removing Nails from Painted Work

When, in repair or alteration jobs, it becomes necessary to drive nails out of a painted or varnished board, the putty and paint around the head of the nail will not crack and spoil the piece, if the job is done as follows: Set the nail to be withdrawn over a soft-pine block; and with two or three taps with a hammer drive the head clear of the putty and into the pine. The block is then removed and the nail withdrawn in the ordinary manner, leaving the hole, instead of jagged and torn, neat and unchanged in diameter.—A. G. Roach, Sudbury, Ont., Can.

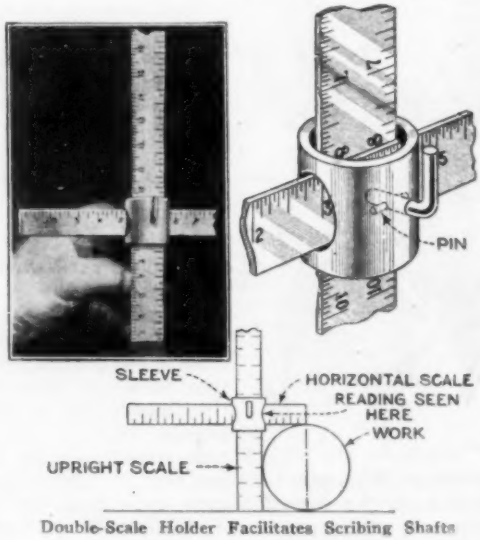
### Steam Boiler Converted into Tank to Drive Compressed-Air Winch

The accompanying photo was taken in the yards of a shop that repairs and builds logging equipment. The winch is operated by compressed air, which also operates a trip hammer and other tools in the shop. A 40-hp. motor is used to pump air into the tank, which is simply an old steam boiler, made over and adapted to this purpose. A pressure of 100 lb. is maintained. —A. F. Kroemer, Portland, Oreg.

Old Steam Boiler Used as Compressed-Air Tank to Operate a Winch, Trip Hammer and Other Air Tools

### Scribing Shafts

A useful device for scribing shafts, or other round work can easily be made up from a sleeve and two scales. A hole drilled through the sleeve takes a 12-in. scale, while a smaller cross hole receives a shorter and narrower scale. Both scales are tightened against each other and against the sleeve by a bent-rod handle. This carries a short pin, which tightens against the side of the hole when the handle is turned in line with the axis of the sleeve. To set and use the device the handle is loosened and the sleeve is slid down until the horizontal scale touches the top of the work. This scale is then moved in or out until the distance between the edge of the upright scale and the end of the horizontal scale is half the diameter of the work. This reading can easily be seen in the cross hole. The handle is now tightened and the work turned until the line meets the end of the scale.—Harry Moore, Montreal, Can.




Double-Scale Holder Facilitates Scribing Shafts

### Finding Boiler Efficiency

Here is a handy rule for roughly determining boiler efficiency when the chimney-gas temperature and the heat value of the fuel are both known:

"Multiply the temperature of the exit gases in degrees Fahrenheit by 625 and divide by the heat value in b.t.u. per lb. Then subtract the result from 100. The result is the approximate boiler efficiency in per cent." The rule worked out with surprising accuracy even in the case of the New York City power plant, where the high efficiency of 92.7 per cent was obtained recently. The chimney-gas temperature was reduced to 193°. The heat value of the fuel was about 14,500 b.t.u. per lb. Applying the rule, multiplying 193 by 625 and dividing the result by 14,500 we get 8.3, and this subtracted from 100 gives 91.7 per

cent. In other words, this rule was only one per cent off when applied to this unusual example.

For oil burners the rule becomes:

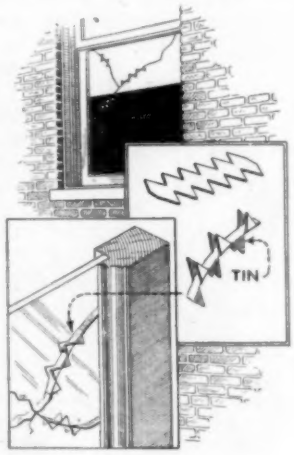
"Multiply the temperature of the exit gases in degrees Fahrenheit by 5,000 and divide by the heat value of the oil in b.t.u. per gallon. Then subtract from 100. The result is the approximate boiler efficiency in per cent."

It must be understood, of course, that in applying this rule the fireman is doing his best to effect complete combustion. If the fire is so poor that the gases contain a large per cent of carbon monoxide, the rule naturally will not hold; nor will it if the exit gases contain too much air.

The usual, but much more complex, procedure in determining boiler efficiency is to find the heat in the steam evaporated by the boiler and divide it by the heat given off by the fuel. In other words, boiler efficiency, like all other efficiencies, is equal to output divided by input. These rules, however, simplify the whole affair. They are based on the reasoning that by deducting the heat passing out of the chimney from the original heat contained in the fuel, we have the approximate amount of heat absorbed by the boiler. Then by dividing the latter amount by the former we arrive at the approximate boiler efficiency.—W. F. Schaphorst, Newark, N. J.

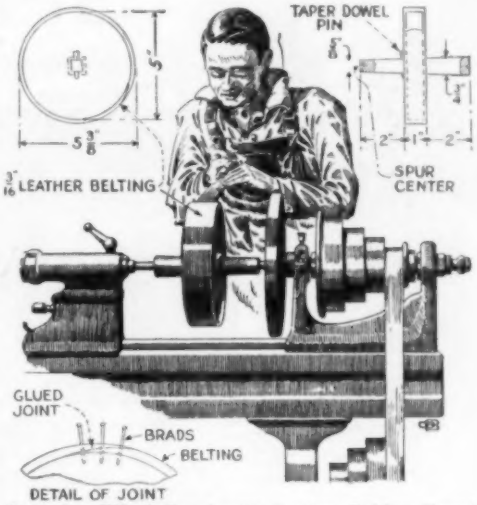
## Repairing Cracked Windows

Cracked window panes are likely to fall out entirely when a hard wind blows or a heavy door slams. This can readily be prevented, however, by reinforcing the broken pieces with strips of tin, about 2 in. long and ¾ in. wide. A number of teeth are cut in each side of the strips as indicated in the detail. The strips are slipped into the cracks and the teeth bent over on opposite sides. This will hold the pieces together securely. —Warren H. Froelich, Menomonie, Wis.




## Making a Stropping Wheel

Pattern and cabinetmakers will find the stropping wheel shown in the drawing will give a better edge to their tools than the ordinary cloth buffing wheel. It consists of a 5-in. disk, turned out of a piece of 1-in. pine. A tapered hole, ⅝ in. square at the smaller opening, is cut in the center for a shaft, which should be made from a piece of hardwood, such as maple or oak, and should measure 5 in. long and ¾ in. square at the large end. This is planed square and tapered so that it can be driven into the wheel to a tight fit and a hole is drilled through the shaft for a small dowel pin, which locks the wheel on the shaft. Center holes are punched in the ends of the shaft, one for the live center and one for the dead center. Mount the wheel in the lathe and trim down the surface of the wheel. A 1-in. strip of leather belting about 3/16 in. thick is laid around the wheel, adding about 1 in. for a lap joint. The ends are shaved down to a taper, as indicated in the detail, and the leather is glued to the wheel. Brads are nailed at the joint to keep the leather tightly on the wheel while the glue sets, after which they are removed and the leather surface trued up. A ⅛-in. recess is turned in each side of the wheel to facilitate sharpening of gouges. In use, the wheel should be mounted in the lathe so that the joint will not catch the tool.

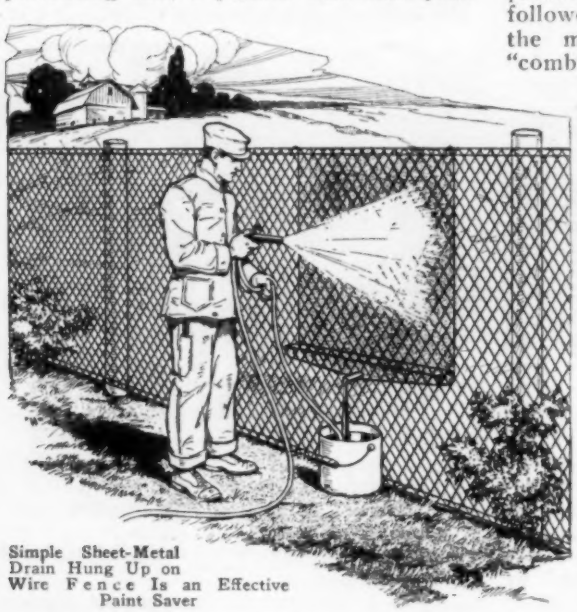



**Stropping Wheel Faced with Leather Belting Found Convenient**

¶Tampering with screws can be prevented by dropping a little solder on the head of the screw, so as to fill the slot.

### Painting Wire Fences

When spraying paint on wire fences, there is considerable waste of paint. Experiencing this, a painter who had quite a bit of fence to paint devised a drain to catch and return the surplus paint. The drain is simply a large piece of sheet metal with the lower edge bent to form a trough so that when the drain is hung up as indicated the paint flows down into the trough, from which it runs into the pail and may be used until practically every drop is consumed.—J. P. Doolan, Alliance, Ohio.



Simple Sheet-Metal Drain Hung Up on Wire Fence Is an Effective Paint Saver

### Inserting Bolt in Awkward Place

An easy way to get a bolt in a hard place is to get a fine piece of copper wire, or, if this is not at hand, a wire from a piece of door screen will do. Double the wire and pass it through the hole from the side that is easiest to put the nut on. Draw the wire through far enough to put it in a position where it can easily be wrapped around the threaded end of the bolt. Now pull gently on the other end of the wire, guiding the head end of the bolt with the fingers or pliers. The wire steers the other end, and the bolt cannot fall out. This idea works well in putting fenders on a car, as often some of the bolts are in an awkward place in the corner of the frame.—Garry Runions, Lunenberg, Can.

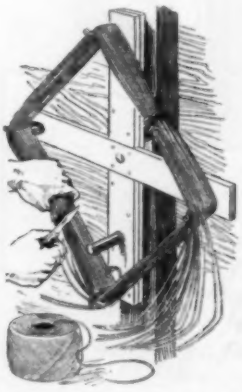
### Soldering Aluminum

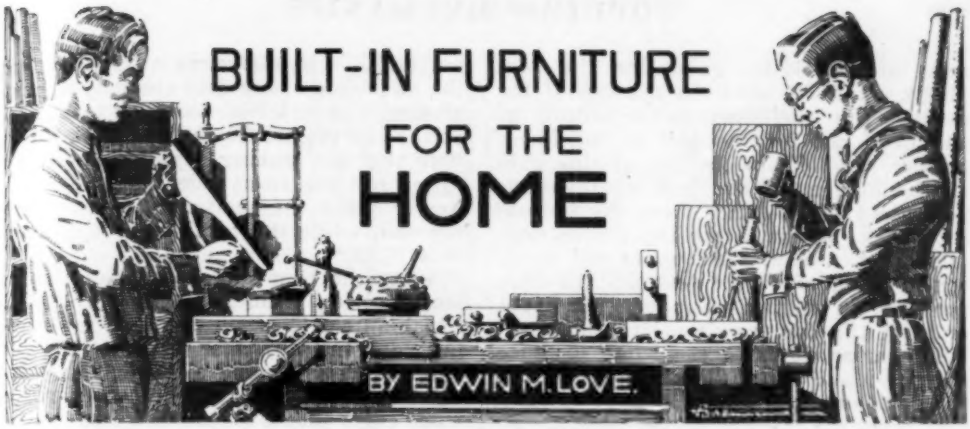
Although aluminum is one of the most difficult metals to solder, the task is comparatively easy if a few simple rules are followed. Most of the solders offered on the market consist of "straight" and "combination" solders. The straight solder is used for soldering aluminum to aluminum, and the combination for soldering any metal except cast iron to aluminum.

The parts to be soldered with straight solder should first be cleaned with gasoline, and by brushing the surface to be soldered with a steel-wire brush to remove all grease. Then heat the parts with the flame of the blowpipe until the solder begins to melt upon them and brush the melted solder well into the metal. If any dross remains on the surface, brush or scrape it off. Each part should be tinned separately, then pressed together and soldered. To use combination solder successfully, one must "tin" the metal to be soldered to the aluminum with some of the combination, using any good flux. After cooling, remove all traces of the flux and prepare the aluminum with some of the straight solder, as described. The parts may then be joined with some of the straight solder without any flux.

### Cutting Equal Lengths of Twine

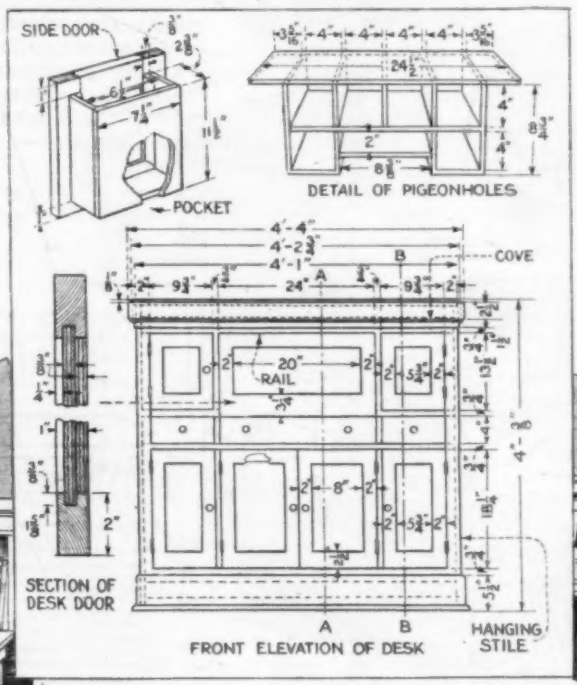
Thousands of farmers cut up their corn and put it in the shock to be hand-husked later, and the husked fodder is then tied up in bundles with twine. Cutting this twine into equal lengths takes too much time and this led to making the simple device shown in the illustration. The twine is wound upon a simple reel over four hooks or nails so placed as to provide the right length of tie cords, as indicated, and after a number of turns the whole bunch is cut with a knife or pair of shears, which makes all the cords of equal length.

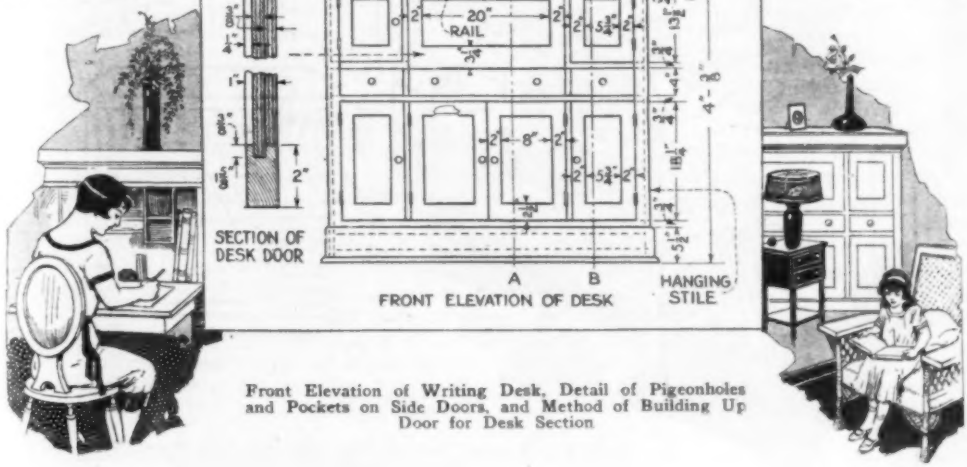





**Part XI—A Built-In Writing Desk**

BUILT in combination with the fireplace or as an individual unit, the writing desk illustrated lends itself easily to use in almost any living room. It is 4 ft. 1 in. wide, 4 ft. ¾ in. high, and 11¼ in. deep. It should, of course, be built near a window if the space is available without doing violence to the beauty of the room. Build the front frame of 1⅛ by 2-in. net stock, making the stiles 3 ft. 11⅝ in. long and the upper and lower rails 3 ft. 8 in., securing each joint with two ⅜-in. hardwood dowels. The upper edge of the lower rail is 6¼ in. above the bottom ends of the stiles; and the lower edge of the upper rail is 4⅛ in. below the upper ends of the stiles. Set the frame aside to dry, and glue up stock for shelves, partitions and top, using 1 by 2-in. and 1 by 3-in. material with 1 by 12-in. stock to get the necessary width. Note that the two main partitions are 12¼ in. wide, the front edges forming stiles. Joint the face edges of stock for the ends, using 1 by 12-in. pine or fir, and lay off for dados, ¼ in. deep, as follows: From the bottom end to bottom of the ¾-in. gain for the bottom shelf, 5⅞ in., 2⅝ in. successively to the



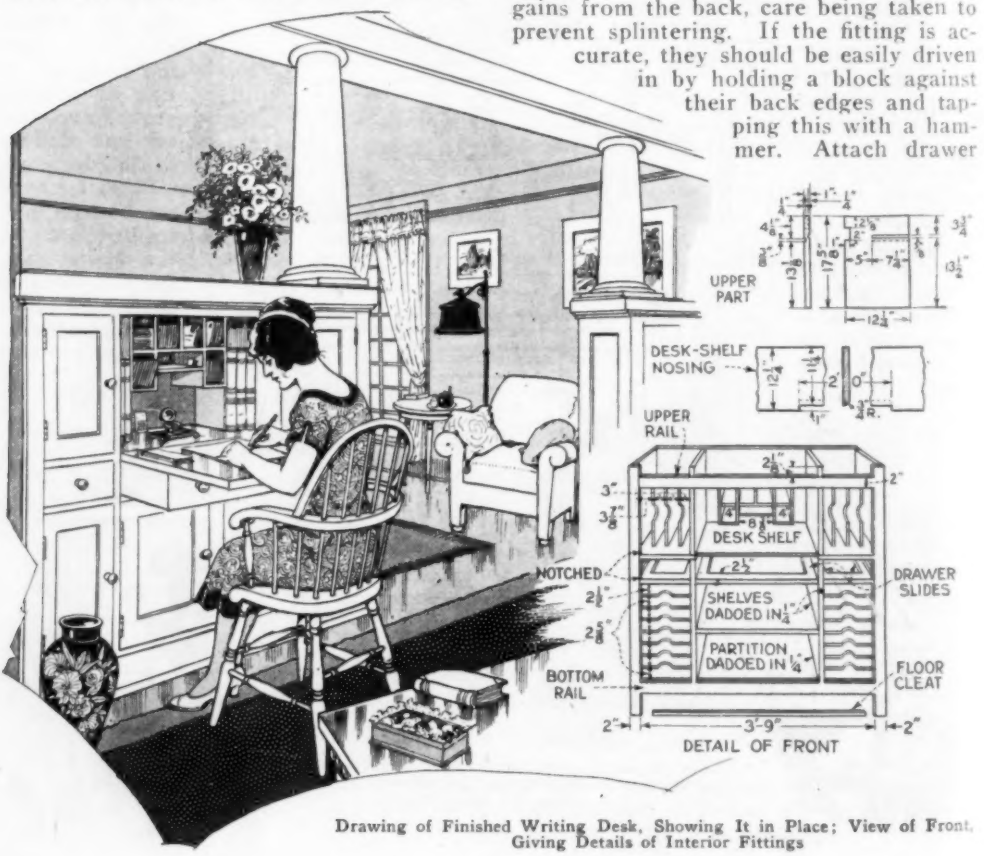
Front Elevation of Writing Desk, Detail of Pigeonholes and Pockets on Side Doors, and Method of Building Up Door for Desk Section

tops of the ⅜-in. gains for the thin shelves, and 2½ in. from the top of the seventh thin shelf gain to the bottom of the dado cut for the end of the lower drawer rail. From the top of this gain to the bottom of the desk-shelf gain is 4 in., and the distance from the bottom of the end board to the top of the desk shelf is 2 ft. 6 in. The upper rail notch is 1 ft. 1½ in. above the desk, and the dado for the thin shelf that supports the upper ends of the thin partitions in the small end compartments is the same distance above. Make the two ends in pairs, joint the back until the board is 11¼ in. wide, and bevel the front edge very slightly to insure a close joint outside with the stile.

The two main lower partitions are 12¼ in. wide, and are grooved for thin shelves to mate with the ends, their own lower ends gaining ¼ in. into the bottom shelf, thus bringing the top of the lower ⅜-in. shelf groove 2⅞ in. above the end. Nine inches above the lower end on the other side a ¾-in. dado is cut for the heavy center shelf, and 8¾ in. above that, the notch for the lower drawer rail. The upper end is 4 in. above, as it butts against the underside of the desk shelf. Note that all the gains end 1 in. from the face edge, as the shelves are behind the doors; also note that for making a joint against the lower rail the front side must be ⅛ in. longer, since the shelf rises ⅜ in. above the rail, while the partition is gained in only ¼ in.

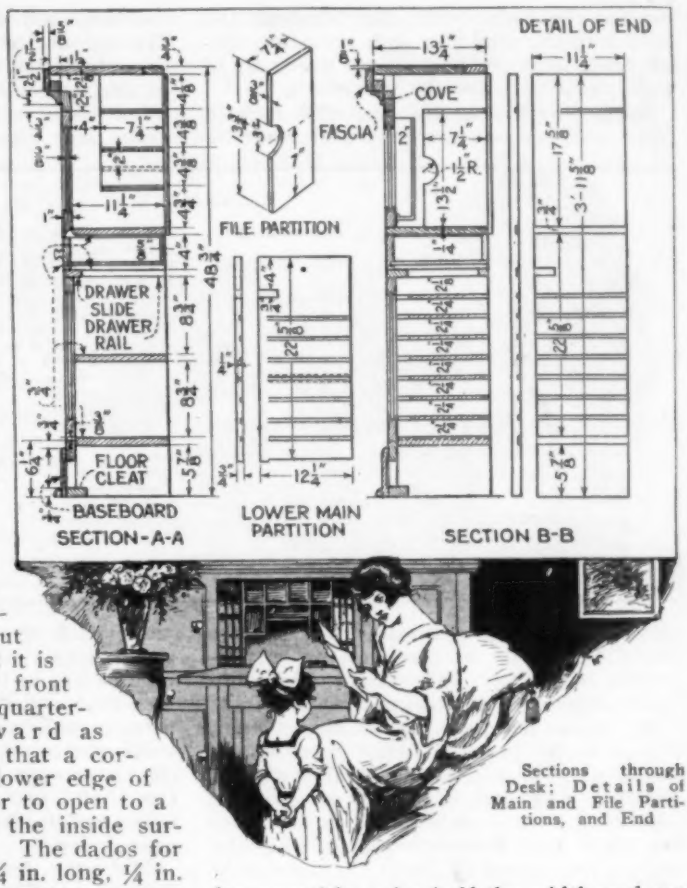
Make the thin shelves of ⅜ by 12-in. stock, giving them a length of 11½ in., which allows ¼ in. on each end for housing into the adjacent members. Their width is 11¼ in., and all have a semicircular segment cut from the center of the front edge, with a radius of 1½ in.

The bottom shelf is 4 ft. long and 11¼ in. wide, gained out for the two partitions. The lower drawer rail is of 1 by 3-in. stock, sized to ¾ by 2½ in., 4 ft. long and notched at the ends to fit around the stiles. Assemble the end boards with the bottom shelf and front frame, gluing the latter and nailing through the face with 6-penny finish nails. Put in the partitions and nail into the lower ends through the bottom. The shelves are slid into their gains from the back, care being taken to prevent splintering. If the fitting is accurate, they should be easily driven in by holding a block against their back edges and tapping this with a hammer. Attach drawer




Drawing of Finished Writing Desk, Showing It in Place; View of Front, Giving Details of Interior Fittings

stiles of 1 by 2-in. stock to the partitions by nailing from the face edge of each with eight-penny finish nails, being careful to keep them square with the front edge. Toenail four-penny finish nails from the ends into the front rail to further strengthen them. The end guides are built up into a T-section by nailing 1 by 2-in. stock edgewise on the face of 1 by 3-in. stock so that, when placed in position against the ends of the cabinet, the 1 by 2-in. guide will be flush with the inside edge of the stile, leaving projection enough on the 1 by 3-in. to form a slide. The desk shelf is 4 ft. long and for the end compartments is 12¼ in. wide; but for the desk compartment it is cut back 1 in. and the front edge is made into a quarter-round, curving downward as shown in the details, so that a corresponding cove on the lower edge of the door permits the door to open to a horizontal position with the inside surface flush with the shelf. The dados for the thin partitions are 7¼ in. long, ¼ in. deep and ⅜ in. wide. The outer ones are 4⅛ in. from the ends, and the others are spaced 3 in. apart. Slide the shelf into the end dados and scribe for notching around the stiles, afterward putting in place and nailing solidly to the lower partitions. Nail through the end board into the shelf, or toenail the shelf from the inside with six-penny finish nails.




Sections through Desk; Details of Main and File Partitions, and End

The upper partitions are made as indicated in the detail, the front edges being notched for the upper rail and dados made in each side for the thin shelves supporting the pigeonholes and thin partitions. Before nailing them to the shelf, tack backing strips on the shelf to insure alinement with the lower partitions, and toenail fast; or if an additional refinement is desired, dado into the shelf.

The thin partitions for the end compartments are 13¾ in. long and 7¼ in. wide. Lay them off by the dados in the shelf and slip into place. Fit the partitions and nail the tops through the ⅜-in. shelf.

To assemble the pigeonholes, notch the long partitions for half the width and cut corresponding notches in the middle shelf, so that the two will come flush front and back, and nail in the short center partition. Cut in the short lower shelf, nail on the ends, and nail on top the long upper shelf. The bottoms of the lower pigeonholes are cut in between the vertical members. Slide the assembly into place above the desk.

The three-ply panel-veneer back shown is optional. If used, it is necessary to remove the plaster from the lath behind the upper part of the cabinet, so that the back will not hold the cabinet away from the wall; or the back may be cut between the partitions, using 1-in. window stop tacked to the ends and partitions as backing. In this case, of course, the pigeon holes and thin partitions must be set forward ⅜ in.

Set the cabinet against the wall, plumbing it in both directions and leveling the rails. Toenail through the ends into the floor, and nail a 1 by 4-in. cleat to the floor flush with the bottom rail as back-

ing for the baseboard. Nail through the back into the studding with six-penny finish nails, or if the back is not used, cut in wall cleats between the partitions.

Scribe the top against the wall, tack in place and lay out for ends and front by measuring from the cabinet itself, the top being 4 ft. 2¾ in. long, giving a projection of 1¼ in. When cut, nail solidly to the ends and partitions. Cut a strip of 1 by 1¼-in. net pine around the cabinet, 2⅝ in. below the top. Miter around the fascia of ⅝ by 2½-in. net wainscot cap, showing a margin of ⅛ in. on the top. The cove miters underneath this. Miter the base and shoe around, scribing the ends where they fit against the baseboard of the room. If the desk is built in combination with the fireplace, or in a recess, the fascia and base will probably terminate in the fireplace or wall.

Build the doors of 1⅛-in. stock. The stiles and upper rails of all doors are 2 in. net in width, except the lock stile of the left-hand door of the pair, which is 2½ in., so that the rabbet will still leave an outside width of 2 in. The lower rail of the desk door is 3¼ in. wide, but all other lower rails are 2½ in. Build the desk door like the others, keeping the panel back ⅜ in. from the inside face so that another thickness of panel veneer may be put in the recess to bring the surface flush. By beveling the edges of this piece somewhat, a very snug joint on all sides can be obtained. Work a cove on the lower edge to mate with the round on the shelf, and hang the door with the hinge inside. Surface all doors to a thickness giving 1/16 in. clearance on the shelves.

Make the drawers without lips, so that the fronts slide flush with the stiles and rails. Give a side clearance of less than ⅛ in. and 1/16-in. clearance vertically. Rabbet the sides into the ends of the fronts and the back between the sides; and assemble front, sides and back before inserting the bottom.

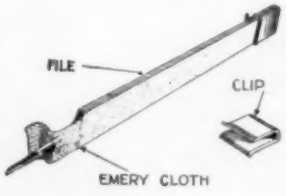
**MATERIAL LIST**

1 piece, 1⅛ by 2 in. net by 16 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 2 in. net by 14 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 2 in. net by 12 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 3 in. by 10 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 4 in. by 2 ft., pine or fir, S4S, sanded.
1 piece, 1 by 12 in. by 14 ft., pine or fir, S4S, sanded.
1 piece, 1 by 12 in. by 12 ft., pine or fir, S4S, sanded.
1 piece, 1 by 12 in. by 6 ft., pine or fir, S4S, sanded.
2 pieces, 1 by 2 in. by 10 ft., pine or fir, S4S, sanded.
1 piece, 1 by 3 in. by 12 ft., pine or fir, S4S, sanded.
1 piece, 1 by 4 in. by 4 ft., pine or fir, S4S, sanded.
1 piece, ¾ in. net by 12 in. by 14 ft., pine or fir, S4S, sanded.
1 piece, ¾ in. net by 8 in. by 16 ft., pine or fir, S4S, sanded.
1 piece, 2-in. cove, 8 ft.
1 piece, ⅜ by ¾ in., base shoe.
1 piece, ⅝ by 3 in. by 8 ft., wainscot cap, sanded.
1 piece, ⅝ by 6 in. by 8 ft., baseboard, sanded.
1 piece, ⅝ in. by 5 in. by 6 ft., drawer side, sanded.
1 piece, ⅝ by 4 in. by 4 ft., drawer back, sanded.
1 piece, 1 by 5 in. by 4 ft., drawer front, sanded.
1 piece, ⅜ by 3 by 3 ft., three-ply pine or fir panel veneer.
1 piece, ⅜ in. by 1 ft. 6 in. by 4 ft., pine or fir panel veneer.
1 piece, ⅜ by 6 in. by 8 ft., T&G drawer bottom.
11 1⅛-in. glass drawer pulls (knobs).
1 desk lock.
5 forg catches.
1 elbow catch.
1 desk chain.
7 pairs 2½ by 2½-in. loose-pin butts.

Cost of materials, about $14.00. Time to build, about 40 hours.

## Clip Holds Emery Cloth on File

Emery cloth, with a file as a "backer," is often used in the machine shop, especially in the hardening departments where scale is removed from work so that color changes during annealing and tempering processes can be watched easily. Ordinarily, a strip of cloth is mounted on a file by stabbing the tang through it, as shown, and the other end is held in place with the left hand. The simple clip illustrated will hold the cloth to the file and keep it stretched, permitting the left hand to be used in the natural way.—C. M. Wilcox, Torrington, Conn.



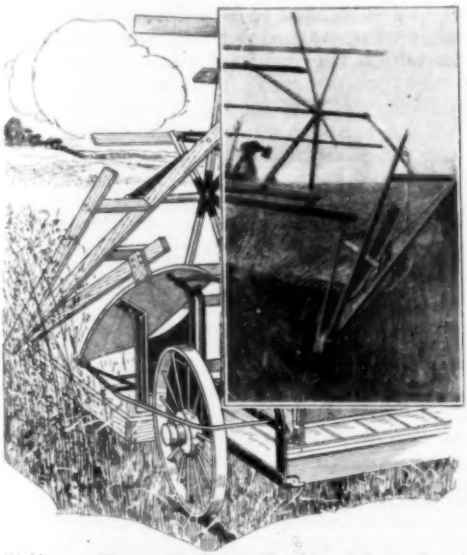

## Storing Small Screws, Bolts and Nuts

The most annoying problem to the amateur mechanic is the storing of small parts, screws, nuts, bolts, and those little things that come in handy every day, yet are continually cluttering up the workbench. The container easiest to obtain and one that is most adaptable to systematic storage, is a red tobacco tin. It has a tight-

fitting cover, is easily labeled by scratching the description of its contents on the painted cover, and best of all, nine of them fit exactly into a discarded Ford coil box. The box should be cleared of wires and coils and can then be hung on a wall or attached to the bench with screws. As it also has a clamp-on cover, it affords a portable receptacle which will fit into most tool boxes. A list of contents can be typewritten and affixed to the outside for convenient reference.—George Parke, Chicago, Ill.

### Divider for Cutting Sweet Clover

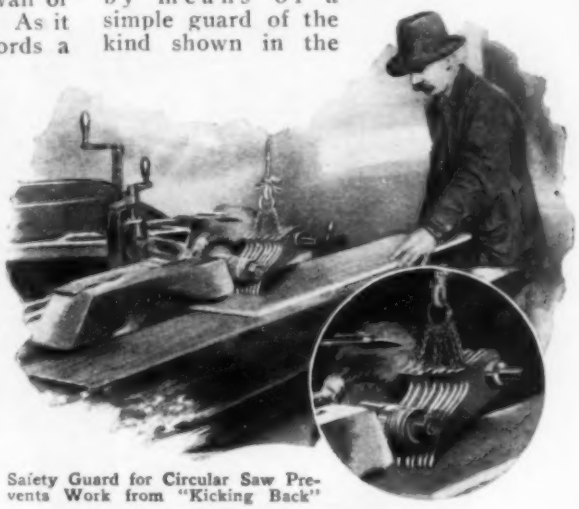
When cutting sweet clover with a grain binder the sickle sometimes cuts off the clover before the divider separates it. This trouble is especially the case if the clover is quite tall. To prevent it, we made a divider by bolting a length of 2 by 4-in. material on the side of the frame so that it extended about 2 or 3 ft. beyond it. Then we took a 1 by 2-in. strip, fastened one end to the projecting end of the 2 by 4-in. length, and bolted the other end to the reel-support standard. Another 1 by 2-in. piece was fastened at the point with the upper end set out about 2 ft. and a third short 1 by 2-in. piece just long enough to clear the reel, was fastened on the inside. In tall clover we remove the outside reel support.—Will E. Smith, Thief River Falls, Minn.



Divider on Mower Facilitates Cutting of Long Sweet Clover

### Guard Prevents "Kick-Back" on Saw

"Kick-backs," which may seriously injure the saw operator, can be prevented by means of a simple guard of the kind shown in the photo. It consists of a number of flat blades, which rest on the work, and are suspended above it by means of a chain. The sharp ends keep the work from coming back.—Auguste Mathieu, Chicago, Ill.



Safety Guard for Circular Saw Prevents Work from "Kicking Back"

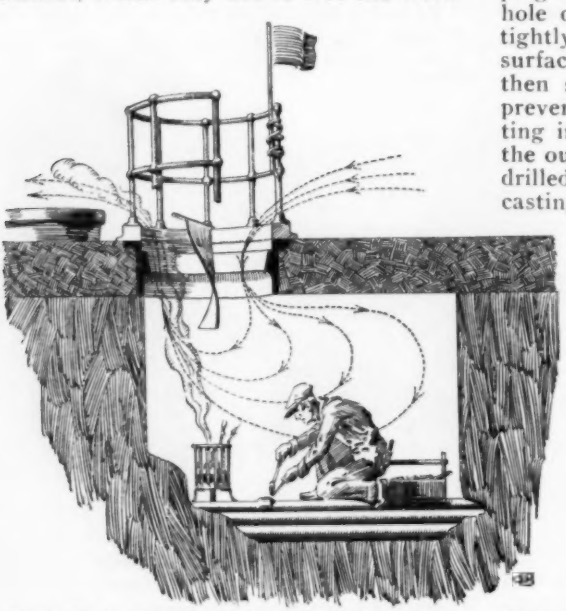
### Tapping Holes in Small Steel Rod

I had to tap two ⅛-in. holes in the end of a small steel rod. In the first place I had no ⅛-in. tap; in the second, it is hard for an amateur to tap so small a hole in steel and there is grave danger of using too much pressure and breaking the tap, which, in so small a size, is very brittle. As in this case the threads did not have to hold much, here is what I resorted to: I drilled ¼-in. holes instead of ⅛-in., coated them with muriatic-acid paste, and filled the holes with solder; then drilled holes slightly smaller than ⅛ in. and cut the threads with the same screws I intended to drive into the holes permanently. They are now in place and very securely.—G. H. Mansfield, Cuyahoga Falls, Ohio.

¶Coal tar stains paint, and therefore it is necessary to insulate it with shellac. Remove as much of the tar as possible by scraping and apply a thin coat of brown shellac. Paint will stick to the shellac, and the stain will not penetrate after this treatment.

### Ridding Manholes of Gas

In an eastern city the linemen working in manholes are provided with a rubber blanket, which they use to free the working chamber of noxious gases. The blanket is hung in the mouth of the hole as shown in the illustration so that a current of air is set up. The fresh air comes in on one side of the blanket and the bad air and gases go out on the other side, as indicated by the arrows.



Simple Method of Ridding Manholes of Gas with Rubber Blanket Which Causes Draft

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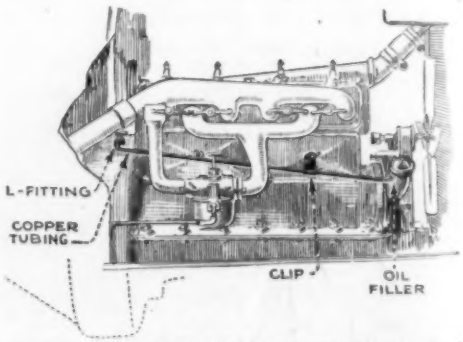
### Outside Oil Line on Ford Motor Makes Quick Repair

Some months ago a Ford on which a connecting-rod bearing cap had come loose was brought into the shop. Investigation showed that no harm had been done to the block or crankshaft and that a new connecting rod would easily remedy the matter. However, the oil pipe was crushed beyond repair, and the owners, a public utility company, would not permit the delay necessary to take the motor apart to install a new pipe. I recalled having seen various outside oil lines for Ford motors, and here was a case to use one. There was none on hand, but there was plenty of ¼-in. copper tubing and fittings, and a little thought showed me that a few feet of this tubing and an L-fitting would do the trick. The transmission cover was removed and a hole drilled and tapped for the L-fitting about ½ in. to the right of the magneto plug and even with the back edge of the plug base. Care was exercised to tap the hole only so deep that the ell would fit tightly and not project beyond the inner surface of the cover. Some waste was then stuffed in the oil-filler opening to prevent any particles of metal from getting in, and a hole, slightly smaller than the outside diameter of the copper tubing, drilled in the back side of the oil-filler casting about ¾ in. from the top. This hole was reamed out with a taper reamer until it was just large enough for the tubing. After this hole was finished, the waste and particles of metal were removed. With the transmission cover back in place, the tubing was bent to run from the L-fitting, around the corner of the block, along the right side of the motor under the exhaust pipe, carburetor, etc., to the hole drilled in the filler casting. After allowing about ½ in. inside the filler opening, the piece was cut off and installed, care being exercised to see that the tube made a gradual slope to the front end of the motor. When the motor was ready for running, it was started at once, and the oil-filler cap was removed so that the results could be observed. A minute after the motor started the oil began to drop from the tube, and in another minute it had increased to a full flow. The principle of operation is this: Some of the oil in which the flywheel runs, is picked up and centrifugal force throws it off, a portion of it finding its way out into the line of tubing, where gravity does the rest. —Leon D. Quick, Milesburg, Pa.




An Improvised Outside Oil Line Installed on a Ford Motor

# How to Lower Your Building Costs

Plan No. 6A20

© Architects' Small House Service Bureau

THE easiest way to lower home-building costs and make your dollars buy full value is to eliminate waste. What is meant by waste?

You have observed homes nearing completion and noted unused lumber lengths, studs, joists, flooring, bricks, etc., strewn around the house and lot. These leftovers usually provide the home owner with kindling wood, but at $30 per 1,000 feet it makes mighty expensive fuel. Another source of waste is the unnecessary use of elaborate finish and expensive equipment. For example, you can spend too much money for your heating plant. You can select a type of brick totally out of comparison, so far as expense is concerned, with the cost of your home. You can build an extravagant, complicated roof, you can overload it with unnecessary, meaningless details and "frills."

These have little or no architectural merit, render no service, detract from the beauty of the house, and certainly pile up your cost to an unjustified amount.

The plan illustrated here is in many ways a model Dutch Colonial home. It is planned to eliminate waste and to provide maximum convenience and comfort within a limited floor area.

For example, it can be placed upon a forty-foot lot. The living room is twenty-two feet deep, eleven feet three inches wide. A simple, but attractive fireplace is the dominating feature. There is plenty of space for large pieces of furniture. The kitchen sink is placed underneath a window with drainboards on one or both sides and with cupboards running to both sides so as to cover the whole end wall of this room.

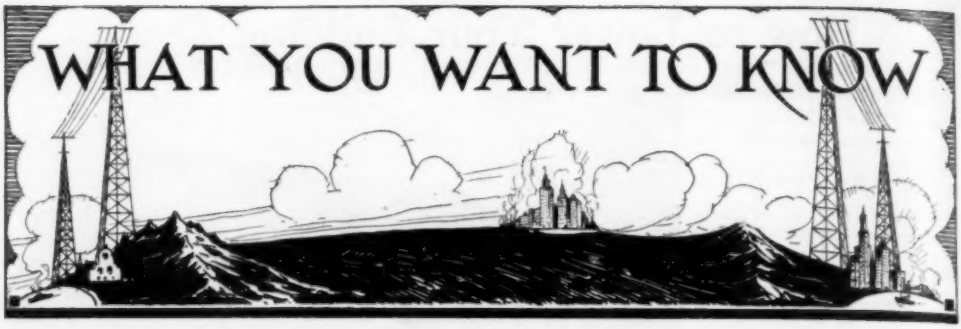
If it is desired to use a coal-burning range, an additional flue can be added in the corner of the kitchen. In the entry way are spaces for brooms and vacuum cleaner, and shelves for the storage of provisions. A feature of this house is the ample supply of closets, ten in number. There is also an attic reached through the closet of one bedroom.

The house is planned to be built of frame construction, siding exterior, shingle roof, brick base course, painted white with green blinds in contrast with the red-brick trim. Here is a big small home that looks good and is good. It has been erected many times at prices ranging between $6,000 and $7,000, depending upon location, quality of materials and equipment.

QUESTIONS regarding home building addressed to this magazine will be answered by the Architects' Small House Service Bureau of the United States, Inc., controlled by the American Institute of Architects and indorsed by the department of commerce, United States government. Blueprints, specifications and material lists for the house shown above may be obtained at a nominal cost. Inclose self-addressed, stamped envelope for reply. If further information is desired send five cents and stamped envelope for a 24-page booklet explaining how the small home bureau functions and showing twelve sample plans.



OCT 8 1925




**Q. How can I tell if my storage battery is low?** A. Get a good hydrometer at any auto-accessory or radio store and follow the instructions for using it. A storage battery used for radio purposes is charged at approximately 1,280 on the hydrometer and should never be discharged below 1,150. (See Fig. 1.)

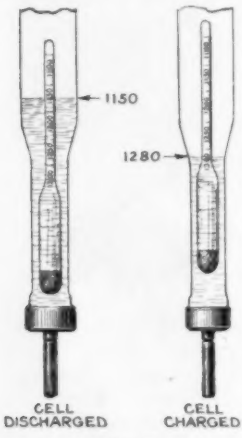



Fig. 1

**Q. My storage battery boils and bubbles when fully recharged. Is this a sign that I am overcharging it?** A. A moderate boiling or bubbling at the surface of the electrolyte after the battery has been on charge for some time is nothing to be disturbed about. This is typical of all storage batteries toward the end of the charge. Any spray left on the top of the cells should be wiped off with a cloth moistened with a dilute solution of ammonia after the charge has been completed, and the caps replaced on the cells.

**Q. How should the prongs on a vacuum tube be cleaned to make a good electrical connection with the spring prongs in the socket?** A. Use a small nailfile to clean the tips of the tube prongs as shown in Fig. 2, taking care not to file off the solder.

Fig. 2

**Q. Will the addition of a step of r.f. amplification add volume to my receiver?** A. R.f. amplification will increase the range of the receiver, but will not affect the volume on stations within 100 miles. Beyond this range it will strengthen the weaker signals.

**Q. I am told that the use of spaghetti tubing will decrease the efficiency of my set. Is this true?** A. Good spaghetti tubing is not detrimental. It should be used wherever there is danger of shorting. It is of advantage when used in different colors to identify high and low voltage, also for retracing leads.

**Q. Do you consider a variable gridleak necessary?** A. A variable gridleak has its advantages, if set at the right place and then left undisturbed. It offers a temptation to the operator to change the setting whenever signals do not seem to be coming in as they should, with the result that the greater part of the time, it is out of adjustment. Hard tubes, when used for detectors, are not as critical as they were some time ago, and a 2-meg. fixed gridleak will answer the purpose in most circuits.

**Q. Should dry cells always stand upright? I have very little room in my cabinet, and would like to lay the cells flat to gain room.** A. There is no reason why you cannot do this. There was a popular belief not long ago that such cells should stand upright, but battery manufacturers now state that their batteries are just as efficient and have the same life when used in any other position.

**Q. Can the new a.c. tubes be used in any circuit?** A. Yes, they are constructed in the same manner as the ordinary tubes except that there is no filament. Any circuit can be adapted to them. Directions for doing this are inclosed with each tube.

**Q. What kind of a circuit is used in the neutrodyne receiver?** A. This is a tuned r.f. set, with one or more stages of r.f. amplification, a detector and one or more stages of a.f. amplification, in its usual form. The method of neutralizing the internal capacity of the tubes is an outstanding feature of this circuit, and the good results obtained have made it very popular.

**Q. What size of wire should be used for connecting the storage battery to the set? Should a fuse be used; if so what size?** A. The underwriters require that 14-gauge rubber-covered wire be used; if a fuse is used, its capacity should not be greater than 10 amp.

**Q. What is the purpose of the detector in a radio set? How does it work?** A. The purpose of the detector is to rectify or filter the r.f. vibrations induced in the aerial circuit so that they can be converted by the receivers into sounds which are not beyond the range of the human ear.

**Q. I now have all the materials to build the Popular Mechanics Superheterodyne Eight, but do not wish to use a loop. We are not greatly troubled with static in this locality, and I would prefer the outside aerial to the loop. What change must I make in the set?** A. Build the set as described in Feb. and Mar. 1925. Then build a small external unit consisting of a variocoupler and .001-mfd. variable condenser. Mount these instruments on a small panel. Tap off the primary of the variocoupler to a switch on the panel, and connect the switch lever to the ground. Take the secondary leads to the two outer loop posts in the set. Connect the center loop post to one of the outer loop posts. Next connect the end of the primary of the variocoupler to the rotor plates of the variable condenser on the small panel, and after this is done, finish by connecting the stator plates of the condenser to the aerial. This will permit you to tune the outside aerial in the usual manner, and does away with the loop.

**Q. Can the house-lighting circuit be used for an aerial and how must I connect it to the set?** A. In frame houses the lighting circuit can often be used, but as you are dealing with 110-volt lines be careful in handling them. Take four lengths of lampcord, join the ends of two lengths and connect this common end to one screw of the light plug, which should be of the separable type. Similarly, connect the other two lengths and attach to the aerial post on the set. The lengths of lampcord are kept together with narrow strips of tape. Follow the drawing, Fig. 3, carefully.

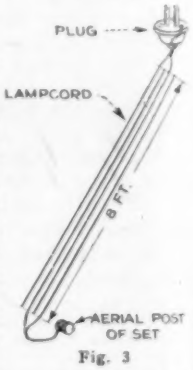



Fig. 3